

# *The* Tool Engineer

.....

ELEMENTS OF BROACHING . . . P. 53

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL  ENGINEERS

JULY, 1951  
VOLUME XXVII, NO. 1

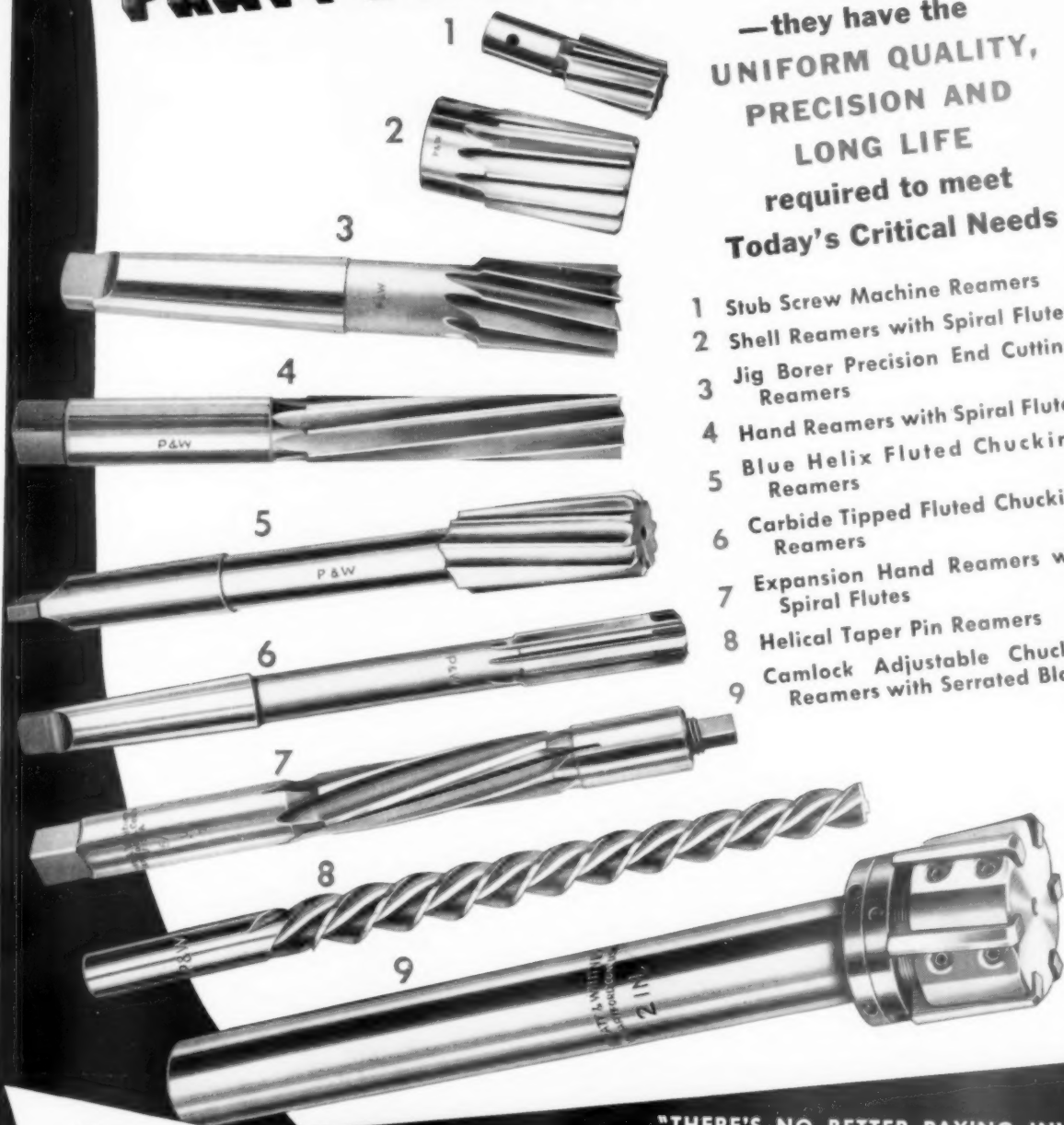
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# The Tool Engineer

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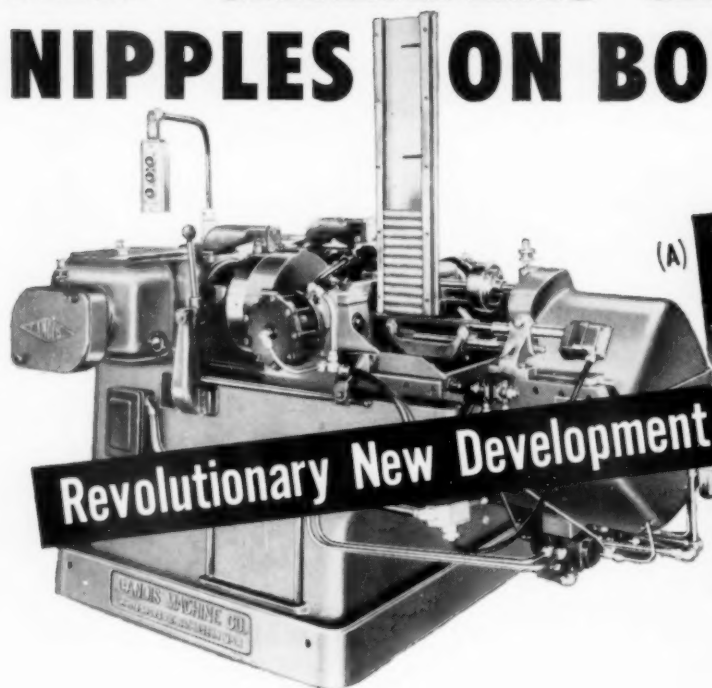
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## AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, \$2.00. Non-members, \$6.00. Canada, \$6.50; all other countries, \$8.00 per year. Copyright 1951 by the American Society of Tool Engineers.  
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(A)

(B)

(C)

(D)

(E)

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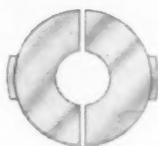


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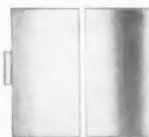
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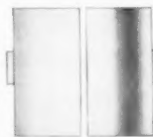
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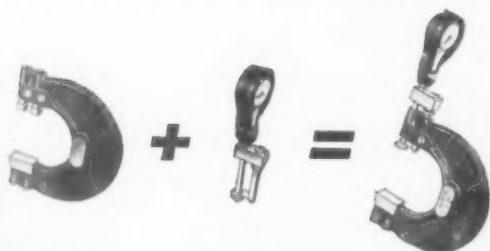
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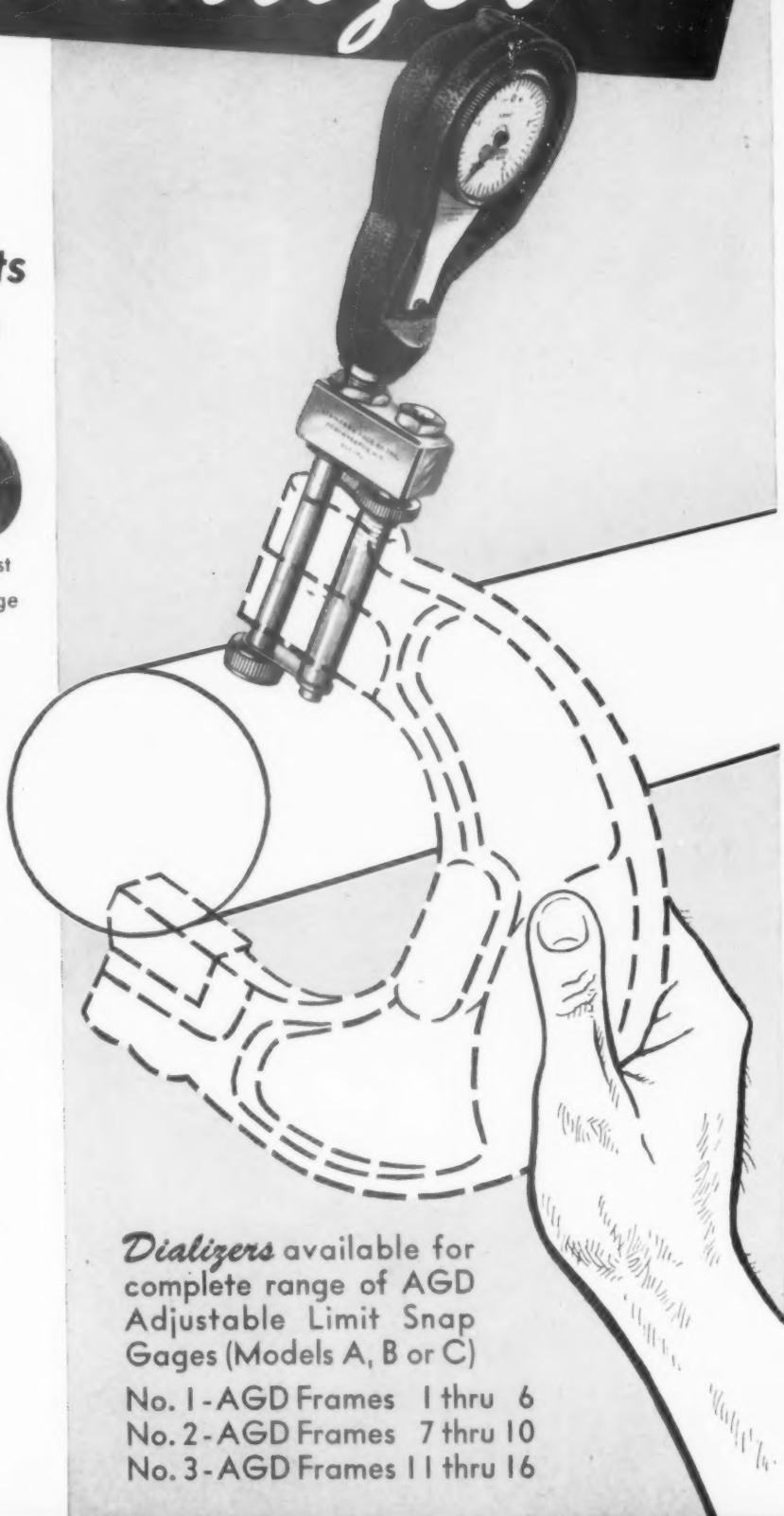
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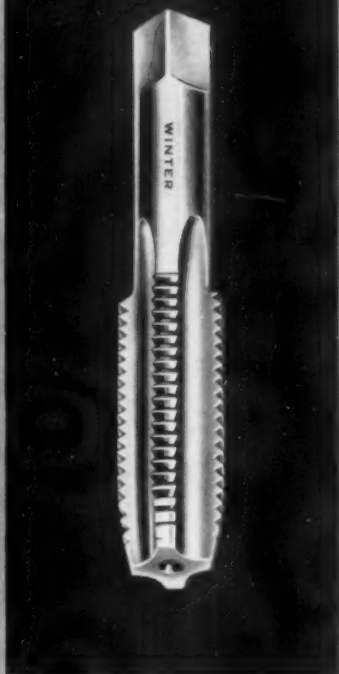


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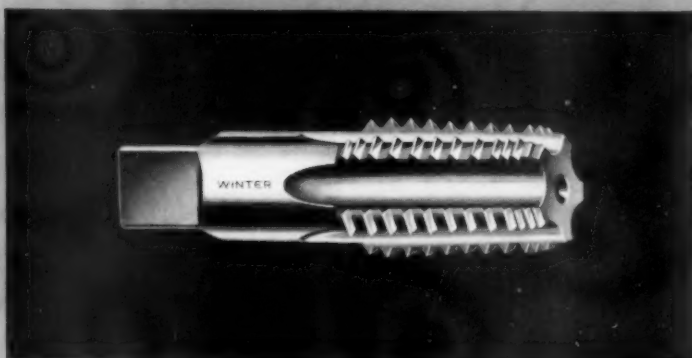
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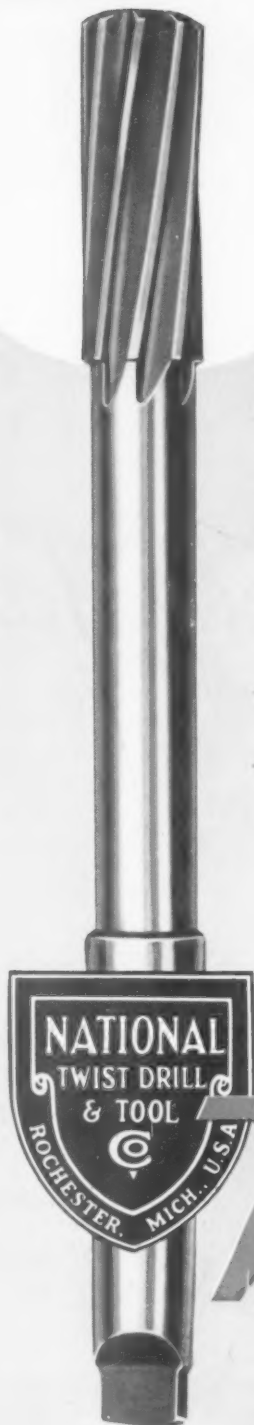


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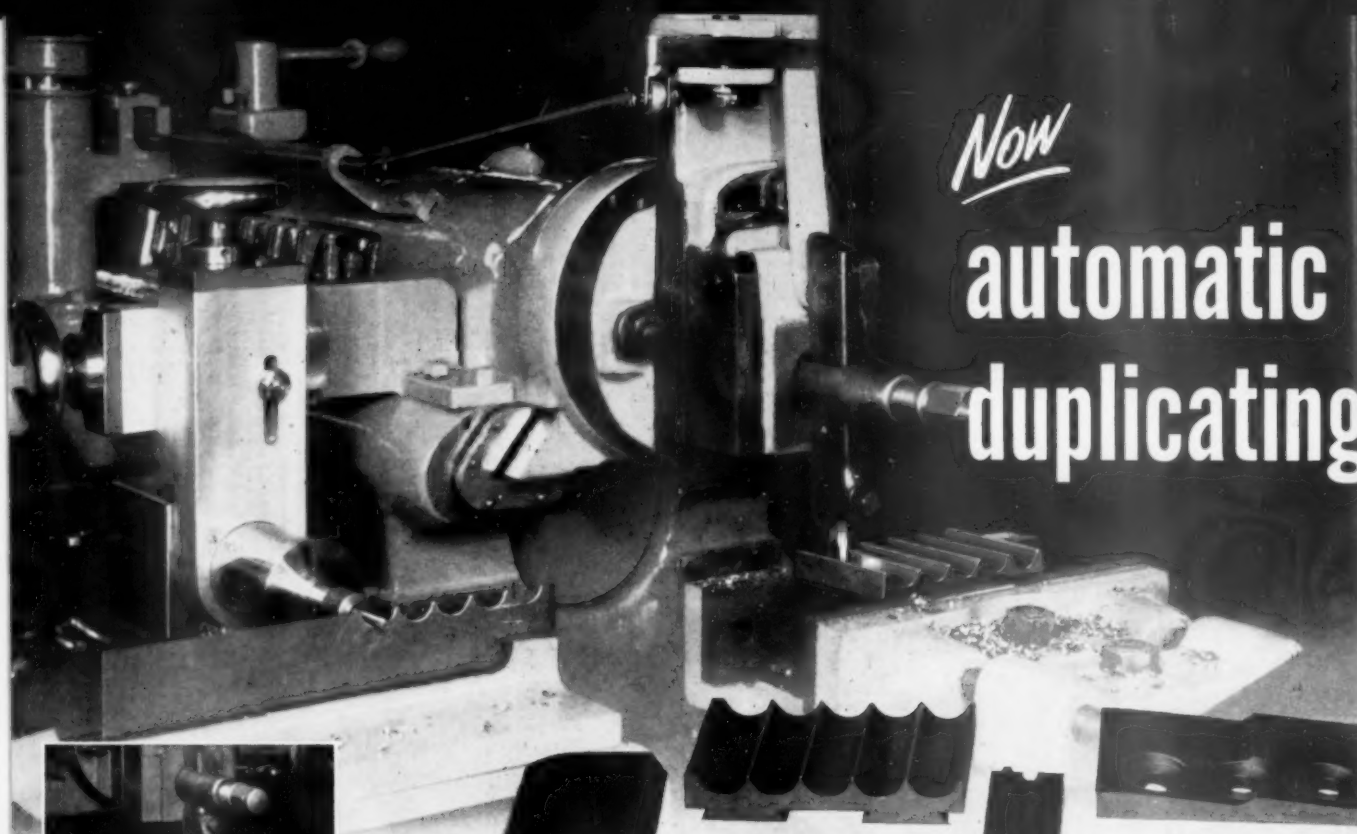


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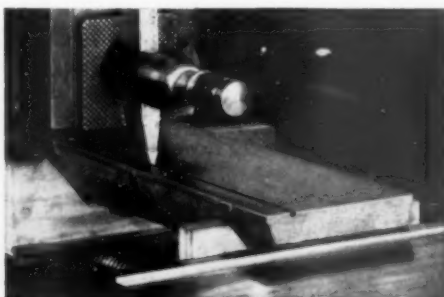
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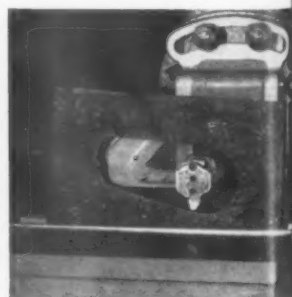
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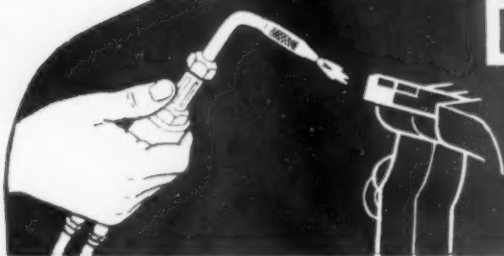
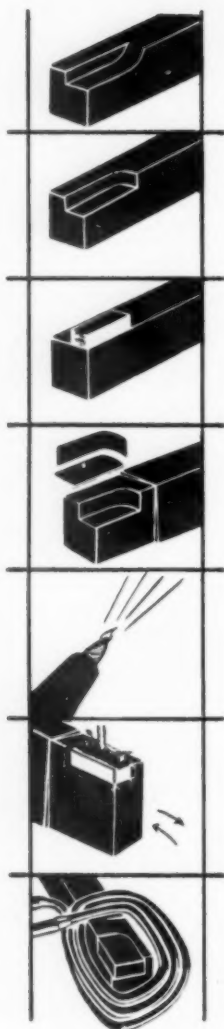
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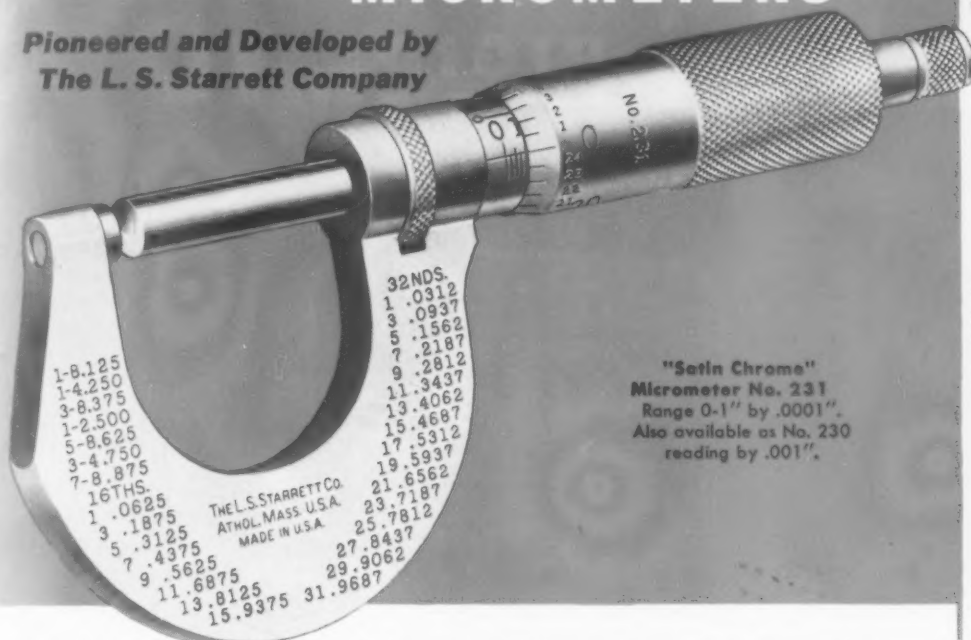
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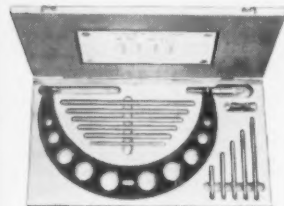
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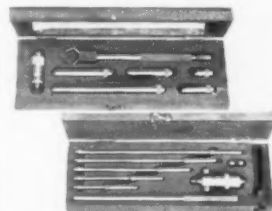
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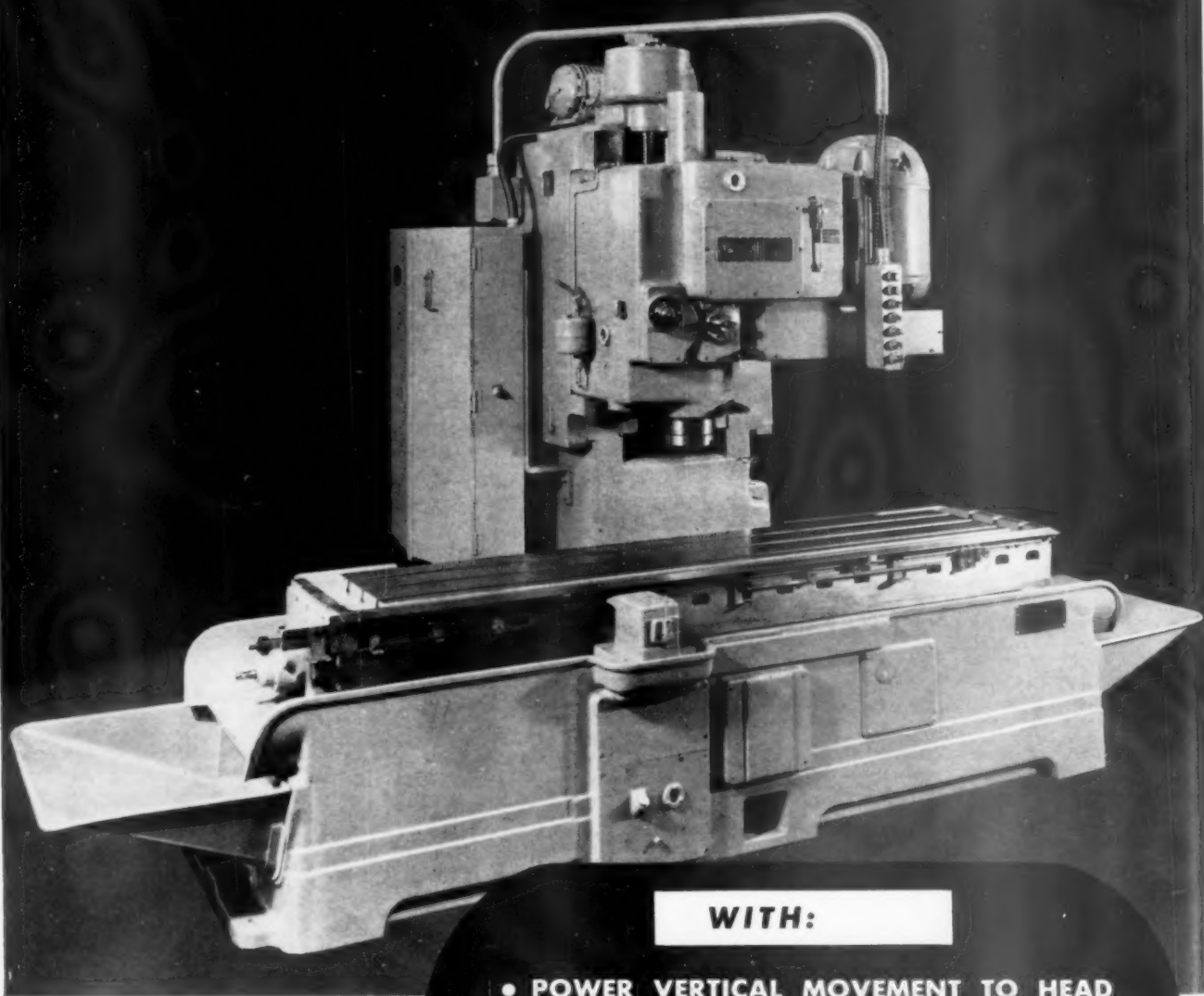
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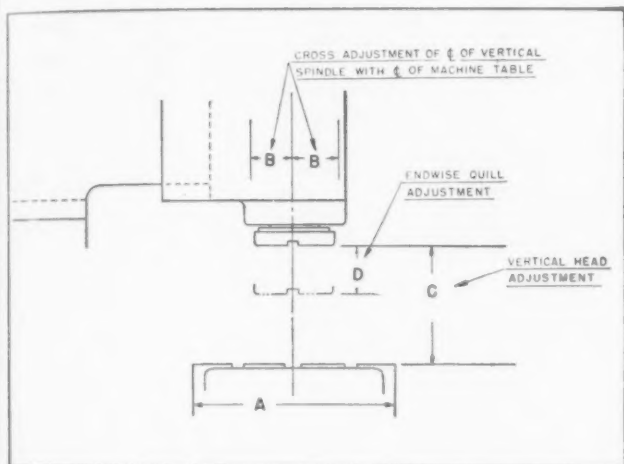
### WITH:

- POWER VERTICAL MOVEMENT TO HEAD
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- POWER POSITIONING TO HEAD CARRIER
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RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

This new vertical spindle arrangement is available with the Sundstrand Models 22 and 33 Rigidmils — up to 25 horsepower heads. The machine has power vertical adjustment to spindle head, endwise quill adjustment and cross adjustment to the spindle head carrier. It is easily and quickly adjusted to handle a wide range of work and to simplify set-ups.



Machine	A	B	C		D
			Min.	Max.	
Model 22	12"	3"	6"	14"	2-1/2"
Model 33	18"	4"	6"	18"	5-1/2"

Schematic drawing of endview and chart showing capacity of new Sundstrand Rigidmil.

## Power Movement To Head

The vertical head is mounted on vertical ways and provided with power vertical movement. This feature makes it possible to clear bosses or obstructions quickly while milling. The range of power adjustment for the Model 33 Rigidmil is from 18" max. to 6" min. between spindle nose and top of machine table.

## FREE DATA

It may pay you to keep abreast of current developments in Sundstrand machine designs. Write for descriptive literature of these new models. Ask for bulletin 709.

## Automatic Table Cycles

Table cycles for these Sundstrand Rigidmils are automatically controlled by dogs mounted on the front of the machine table. The dogs are easily adjusted and proper set-ups for production milling operations can be made quickly. A wide variety of table cycles are available and feed rates range from 1/2 to 50 or 1 to 100 inches per minute. The rapid traverse rate is 300 inches per minute.

## Power Positioning To Head Carrier

The vertical head is mounted on an adjustable carrier which provides the vertical spindle with four inches of cross movement either side of the center line of the machine table. This cross adjustment is made easily and quickly by power. All movements are controlled by push button.

## Automatic Cutter Relief

At the completion of the cut, the spindle head automatically retracts for cutter clearance on the return stroke and is automatically re-set at the end of the return stroke for the start of a new cycle.

The machine can be hand controlled by push buttons for single job set-ups or automatically by table dogs for production milling.



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Machine Tool Company

2540 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES

SPECIAL MILLING AND TURNING MACHINES

An illustration of a logger wearing a hat and plaid shirt, climbing a large tree trunk. The logger is holding a chainsaw and a rope. A large log is being cut from the top of the tree. The background shows a forest with other trees.

*He's a Top Specialist*

**...and so is each of these**

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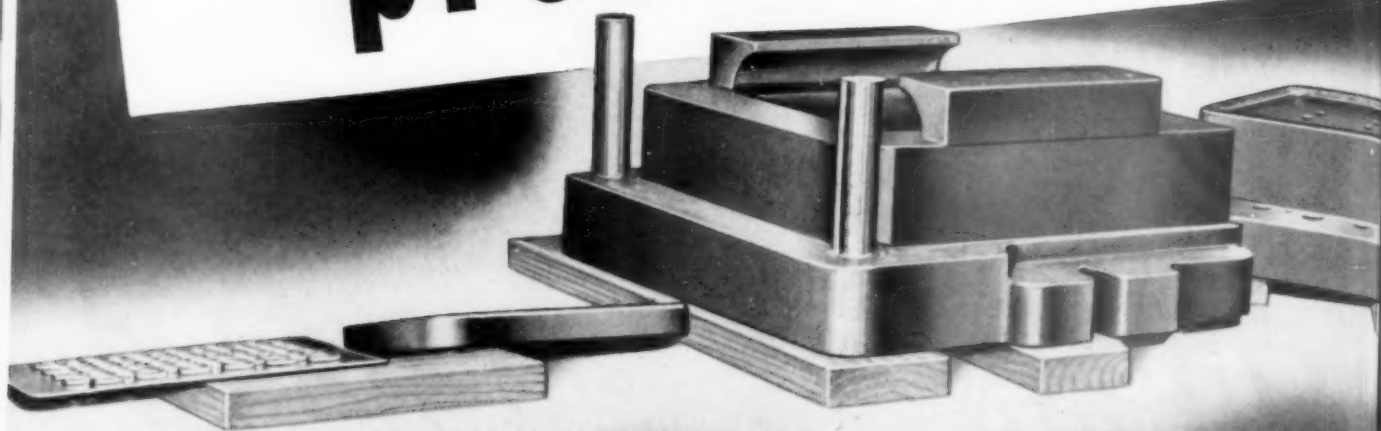
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Warehouses in New York, Chicago, Detroit, San Francisco

# MORSE

## Cutting Tools

# 500% more production



**STEWART-WARNER CO.**  
Indianapolis, Indiana

**MATERIAL DRAWN**

**ORIGINAL DIE**

**ORIGINAL  
PRODUCTION**

**NEW AMPCO DIE**

Grade of Inconel used — Type AN-QQ-N-271, 16 gage Condition A,  
Commercial Soft. Type press — No. 8 Consolidated with air cushion.  
Speed of press — 25 strokes per minute.

Original construction of die — Sectional punch of high carbon, high  
chrome, tool steel, hardened and ground. Form blocks for wiping up the  
sides were inserts of high carbon, high chrome, hardened and ground,  
with draw radii polished. These were mounted in cast iron retaining block.

Location of parts — parts are located on pins mounted in air operated  
pressure pads. Results of operation prior to change—due to inconsistency  
in application of drawing compound, metal pickup on the draw radii  
caused the corner holes to become elongated and form oversize. Inserts  
had to be replaced after 2,000 pieces due to wear. The die required  
polish on the draw radii every 50 to 100 parts formed.

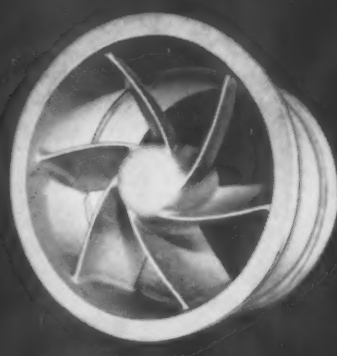
Change to Ampco — A grade 24 Ampco solid casting, 2 inches thick was  
inserted in the same cast iron retaining block and machined to form  
dimensions. Draw radii were polished.

**RESULTS OF CHANGE** — Greatly increased production — "Over 10,000 parts have been formed over  
this insert. No polishing of the draw radii has been required and the insert shows little indication of wear."

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— Centrifugally-cast of Ampco Metal. Note contours on ID.



Pump diffuser — Cast of Ampco Metal.



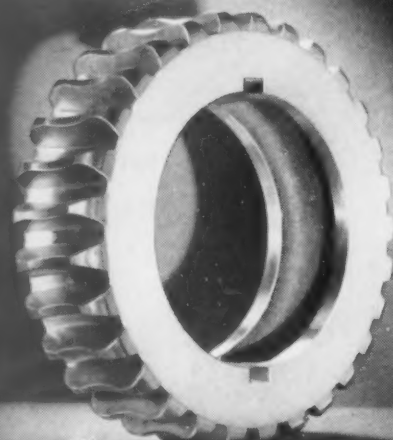
Meter housings and fluid ends — Sand-cast of Ampco Metal.

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# AMPCO<sup>\*</sup> METAL

The savings effected by the greatly increased production reported on the opposite page are typical of results obtained when long-wearing Ampco Metal is correctly applied. Wear-resistance, compressive strength, high impact and fatigue values, excellent bearing qualities, corrosion resistance — all these are cost-saving properties that make Ampco aluminum bronze alloys ideal for longer life and reduced downtime in many applications. Only a few can be shown here. Consult your nearest Ampco field engineer, or write for complete details.

\*Reg. U. S. Pat. Off., Ampco Metal, Inc.



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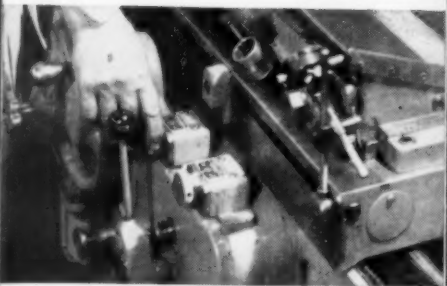
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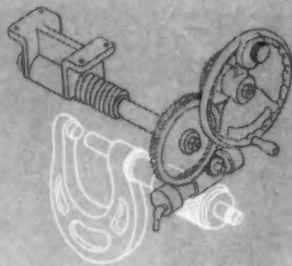
## OPERATORS SAY —



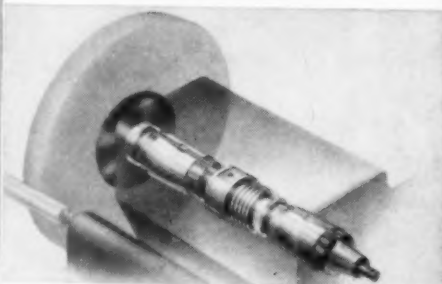
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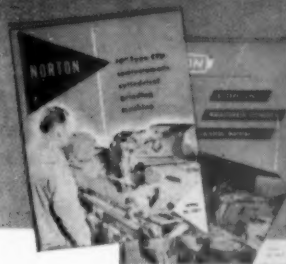
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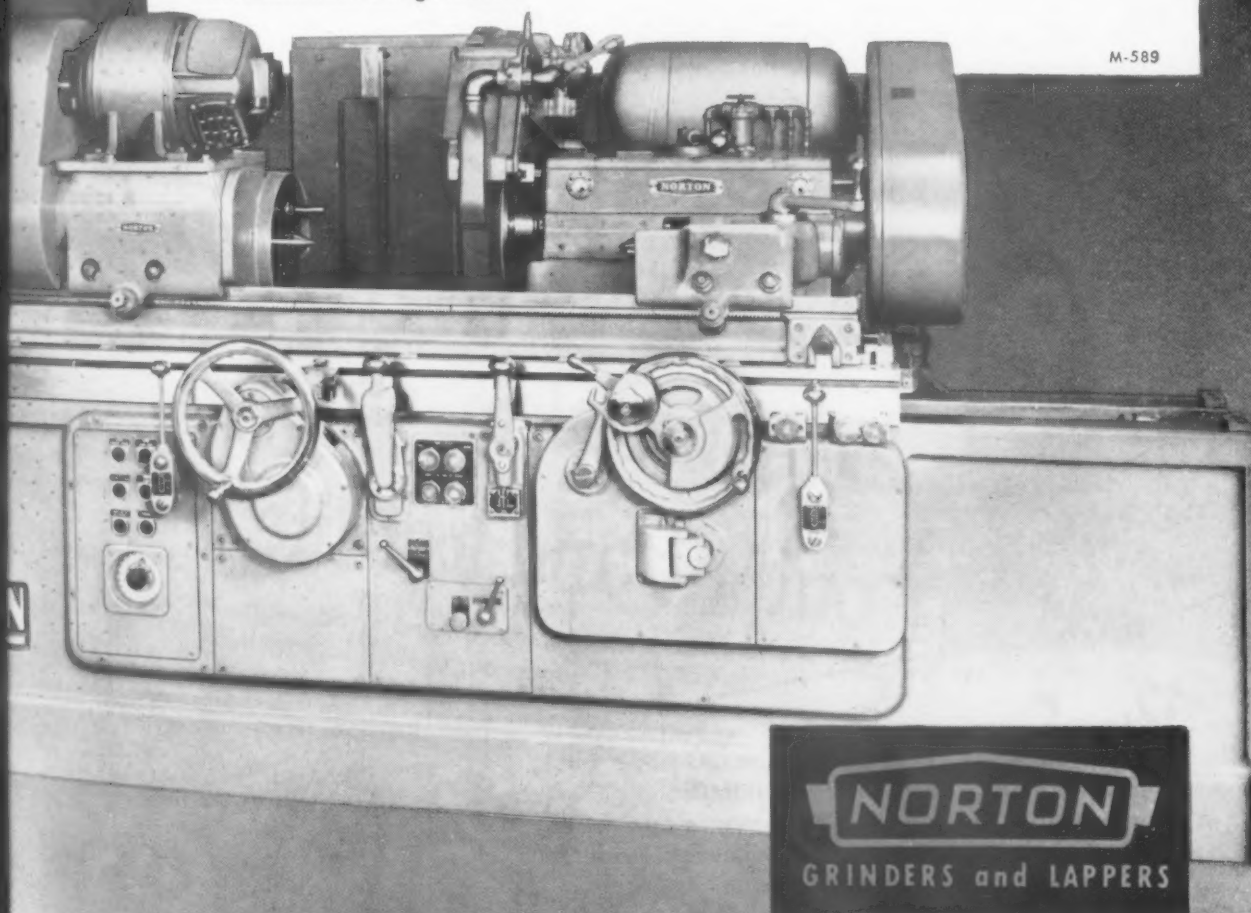
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### THE TOOL ENGINEER

Publication of The American Society of Tool Engineers

# The Tool Engineer

## a Letter from the Editor...

It gives me a great deal of personal satisfaction when, from time to time, I am able to announce a new service, or a new department or feature to *Tool Engineer* readers.

This month, after a considerable amount of preliminary planning, I'd like to introduce a new *Tool Engineer* service to all readers who will make use of it.

Many of our readers, working on Government prime contracts or overloaded with their own product requirements, are in increasing need of sources of supply of parts, subassemblies or added capacity on specific metalworking operations. Others, with engineering departments loaded to capacity, are in need of independent engineering services with the capacity and the experience to handle the job. Materials, special services or parts, consultation, tooling—all these are needed immediately by some manufacturers.

On the other side are many other manufacturers, not yet converted to defense work, or engaged in limited production because of materials difficulties, to cite one common complaint. The range of open capacity here is tremendous, ranging from simple metal-forming or machining operations to complex assemblies or highly capable engineering consultation.

Thus *The Tool Engineer's* clearinghouse service, as a part of ASTE's services to industry, will bring together customer and supplier, *gratis*. Shortly, detailed announcements will be sent to all services, major prime contractors and suppliers. Meanwhile we invite you to mail, phone or wire your needs. We'll promptly forward a list of those firms who can supply what you need. If you're looking for work to fill your plant, let us know immediately—we'll place your plant on file, classified according to equipment and facilities, and type of work desired.

Gilbert P. Muir

**this  
pad**

**and this  
radius**



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# The Tool Engineer

## Editorial

### Whose's Responsibility?

AS MANY COMMENTATORS, including ourselves, have pointed out in recent months, the nation's shortage of trained engineers is a serious matter. Further, it could become much more serious should we be plunged into an all-out defense effort.

On whose shoulders falls the responsibility for building and maintaining an adequate professional force of experienced engineers, qualified by education and practice to head up tooling projects, run production departments and supervise plants and operations?

One might suggest three institutions which influence the professional development of the engineer. The colleges, of course, furnish formal education training. Technical societies such as ASTE aid his professional development after he leaves the engineering school. Industry completes his training on the job.

Considering these three institutions, it is apparent that the work of the first two in developing trained engineers depends almost solely on the demand for engineering talent as expressed by industry. In other words industry sets the quota of new engineers by its policies of maintaining permanent, adequate engineering staffs, and of encouraging potential engineers with reasonable levels of income. By reasonable levels of income we mean starting salaries and salary levels for experienced engineers that are on a realistic par with our changing economy.

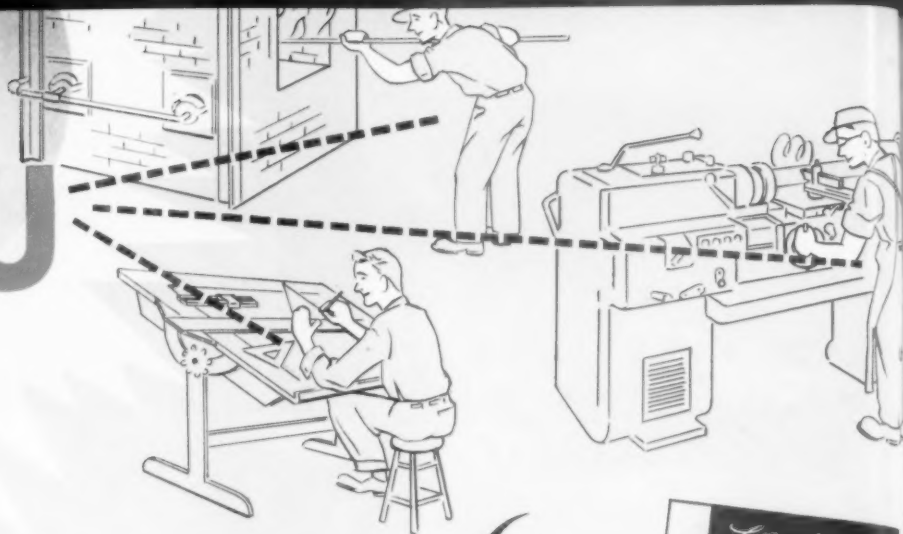
The conclusion, therefore, is that a present scarcity of engineering talent, and particularly tool engineering talent, is for the most part attributable to past mistakes in judgment by industry. And a strong force of responsible, experienced engineers in the future will be a result of a change in industry's thinking.

J. J. Demuth

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## LATROBE DESEGATIZED\* BRAND MOLYBDENUM HIGH SPEED STEELS

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# Machinability Measurements

## On Constant-Pressure Lathes

By Francis W. Bouiger

SUPERVISING METALLURGIST  
BATTELLE MEMORIAL INSTITUTE

THE TERM "MACHINABILITY" has a different meaning for different people. However, tool engineers and metallurgists would probably agree on a simple definition. Machinability might be defined as *the capacity of a metal for rapid processing in a machine shop by routine procedures*. The production man judges the machinability of a metal by the limiting production rate, tool life, surface finish and power requirements in a particular operation. To a metallurgist, machinability is a complex property which controls its behavior in metal cutting. Like other properties, it is controlled by composition and microstructure of the metal.

The machinability of a metal is best measured by a cutting operation. Despite generalities stated in the current literature, reliable machinability ratings can not be obtained from hardness and tensile tests. There are many reasons why conventional mechanical tests should not be expected to indicate machining qualities. Although all properties of a material are controlled by composition and microstructure, the correlation between properties is usually too general to be useful.

Hardness has frequently been used as a rough indication of machinability. Unfortunately, however, many differences in composition, which have a marked influence on cutting quality, do not affect hardness or strength. Conversely, some changes which strengthen metals permit them to be machined at faster rates. The pitfalls of using hardness values to judge machinability are illustrated by Fig. 1. The data, taken from the Metals Handbook<sup>(1)\*</sup>, are based on commercial machining rates for various materials. The ratings for metals with a

Brinell hardness of 190 to 210 cover a fourfold range from 30 to 140. Similarly, five steels have a rating of 50, although their hardnesses vary from 110 to 220. It is obvious, therefore, that hardness is a poor indicator of machinability. Even among steels of the same grade, other factors are usually more important than hardness.

Machinability is an elusive property to measure. Like other properties of metals, machining quality is not entirely independent of environment. In fact, the relative ratings of different alloys can vary with the cutting operation. This is illustrated by the experimental data shown in Fig. 2.

Drilling tests made by Cook and Davis<sup>(2)</sup> suggested that increasing the copper content of leaded brass, from 57 to 63 percent, impaired machinability. Conversely, the sawing test showed that this change in composition was beneficial. This seems to be the right answer. The machinability ratings based on the sawing test agree with those reported by Crampton<sup>(3)</sup> for sawing, drilling and milling tests. Furthermore, commercial experience shows that higher copper contents permit higher cutting speeds in almost all operations. For this reason, free-cutting leaded brass made in this country usually contains 61 to 63 percent copper.

Discrepancies of the kind illustrated by Fig. 2 are caused by differences in the importance of chip removal and chip disposal in different operations. In the case of the high-copper alloys cited, the chips probably clogged the flutes of the drill and interfered with drilling. Chip disposal problems can even occur in a simple machining operation like sawing. Chips which are easily removed from the workpieces can cause difficulties by clogging fine-toothed saw blades. Difficulties in chip disposal usually explain why materials superior in

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

\* Numbers refer to bibliography listing.

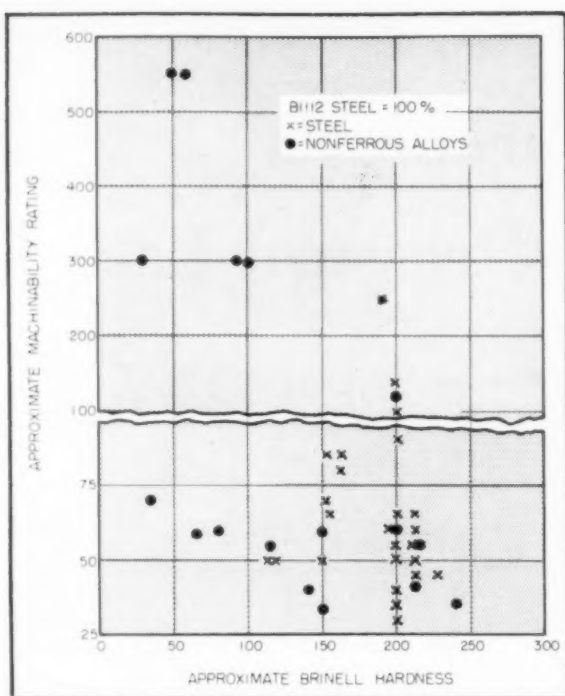


Fig. 1. Plotting of hardness against machinability rating reveals poor correlation.

milling or turning operations may not perform well in drilling or tapping.

In any machining operation, a tool is pressed into the workpiece and removes metal as a chip. The chip is deformed and compressed as it slides across the face of the tool. During the operation, the machined part of the workpiece rubs against the end of the tool. Heat results from these three actions. In fact, about 99 percent of the energy required for metal cutting is converted into heat. The portion of the heat transferred to the tool is important, because it softens the tool and shortens its life.

### Cutting Analysis Made

The best analysis of metal cutting was made by Ernst and Merchant<sup>(4, 5)</sup>. Their theories teach that the machining quality of a material depends on three properties:

- (1) The flow strength of the metal being deformed in the chip.
- (2) The effect on the strength of compressive forces normal to the shear plane.
- (3) The coefficient of friction between chip and tool.

There are reasons for believing that differences in frictional properties of metals are usually the most important from the standpoint of machinability. In addition to logic, commercial experience shows that friction is objectionable in machining. Almost all successful improvements in machinability of metals have been based on reducing friction. Among the examples which can be cited

are the following additions to metals:

- (1) Sulphur, selenium and lead in ferritic steels.
- (2) Lead, sulphur, selenium and tellurium in copper alloys and austenitic steels.
- (3) Bismuth, silver, and indium in austenitic steels.
- (4) Lead, tin and antimony in aluminum alloys.

A constant-pressure test is the simplest way of comparing the frictional properties of a metal during machining. In a lathe test of this kind, the feed depends on the friction between the chip and the tool. The reaction of the chip sliding across the top face of the tool must balance the applied horizontal thrust force.

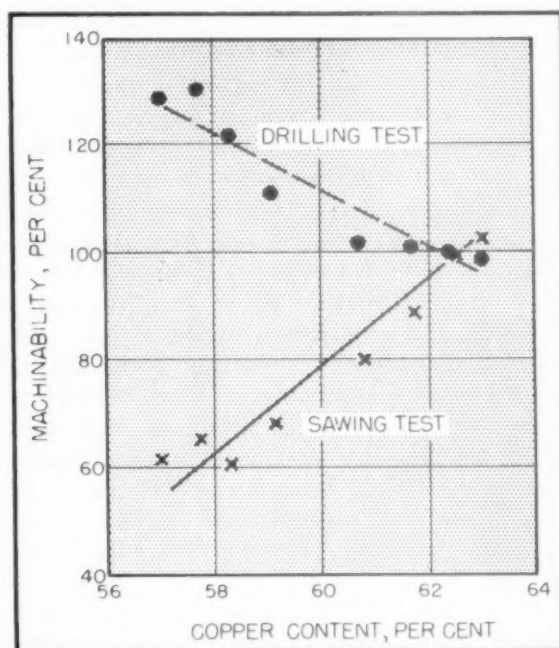
It is easier to measure the feeds resulting from a constant-thrust force than to measure tool pressures for a constant feed. Observations by several investigators show that the relationship between feed and thrust force is:

$$\text{Thrust force} = \text{Constant of the material} \times \sqrt{\text{feed}}.$$

The formula shows that the feed is a more sensitive indication of differences between materials than tool pressure. For instance, a material can have a "constant" twice that of another metal. Since thrust and the "constant" are proportional, the first metal will produce twice the thrust on the tool when cut with a constant feed. For a particular thrust force, however, doubling the "constant" reduces the feed to one-fourth. This compensation is obtained automatically in constant-pressure lathe tests.

Constant-pressure machinability tests can be made on saws, drills, or lathes. Lathe tests are

Fig. 2. Graph shows sensitivity of machinability to testing methods; Cooke, Davis<sup>(2)</sup>.



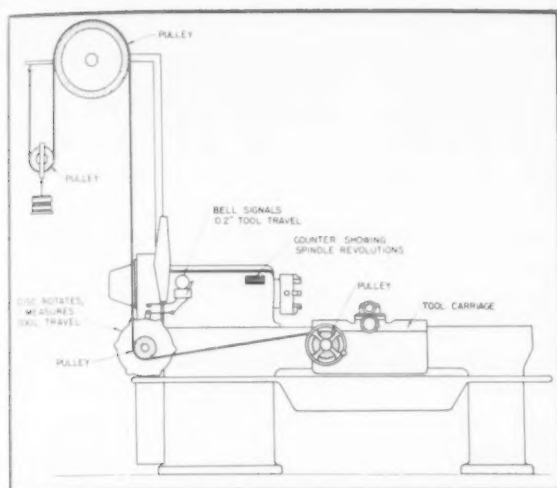


Fig. 3. Sketch of machinability testing lathe.

ordinarily most useful, because they simulate machining operations of greatest practical importance. Special equipment developed for such tests and the procedures recommended were described in a previous publication<sup>(6)</sup>. However, a few details will be repeated because tests can be made on conventional lathes slightly modified for the purpose.

### Machinability Test Equipment

The equipment necessary for constant-pressure machinability tests is comparatively simple. It consists of a lathe disconnected from the fixed feed mechanism, a means for applying a predetermined thrust force on the tool, and devices for measuring tool travel and spindle revolutions. Such equipment is shown in Fig. 3.

Usually the tests consist of taking turning cuts on round bars. Instead of using a fixed-feed lathe, the thrust pressure is applied by a weight-and-pulley system. The weight causes a torque on a drum behind the hand wheel, and this force is transmitted to the tool carriage by the rack and pinion. A cam-operated counter indicates the number of spindle revolutions. As the carriage moves, the cable rotates a device which rings a bell for each interval of 0.2-in. travel. The operator records the reading on the revolution counter every time the bell rings. The readings are used to calculate feeds or machinability test ratings.

A test consists of cutting a standard steel and several unknown samples, for a distance of two inches, with the same tool. Cuts are made on the standard at the beginning, middle, and end of cuts on a group of specimens. Ordinarily a sample of B1112 steel is used as the standard for comparison. Machinability ratings are based on results obtained with six tools in order to compensate for unintentional variations in tool conditions. The ratings are based on the assumption that steels with better machinability cut better in the test.

The machinability rating of a sample is equal to:

$$\frac{\text{Average feed on sample} \times 100}{\text{Average feed on standard}}$$

Since the feed corresponds to 0.2 in. divided by the counter reading, the machinability rating is also equal to:

$$\frac{\text{Counter reading for standard}}{\text{Counter reading for sample} \times 100}$$

Several precautions are necessary for securing reproducible results in constant-pressure machining tests. The tool shape and finish, the depth of cut and surface speed of the workpiece should be controlled. Conditions found to be suitable for testing Bessemer free-cutting steels include the following:

Speed: 75 to 85 surface feet per minute

Thrust: 81 pounds for a  $\frac{1}{8}$ -inch-deep turning cut

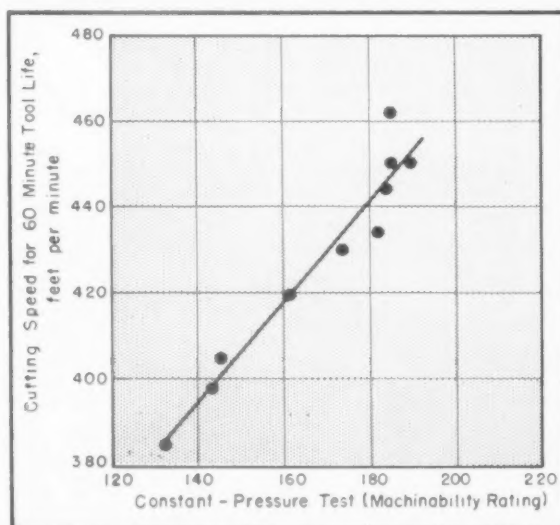
Tools: High-speed-steel tools, with 12 deg side relief and side rake angles. Tools should be ground and honed before each test.

The results reported in this paper were obtained in dry-cutting tests under the conditions stated. Similar data can be obtained when using other testing conditions. For example, it is frequently desirable to test poor machining steels at slower cutting speeds. A speed about one-third that used commercially for the grade is normally satisfactory.

The reliability of a new testing method can be judged by comparing its ratings with those obtained by older methods.

For example, a screw machine company found that three Bessemer steels of the same grade performed quite differently in a carefully controlled operation on an automatic machine. That is, the tool lives were quite different when the steels were machined by identical practices. Therefore, samples were obtained from the three lots and tested in a

Fig. 4. Correlation between machinability ratings of two laboratory testing methods.



constant-pressure lathe. Garvey<sup>(7)</sup> reported the following information for this comparison:

	Tool Life, Hours	Laboratory* Rating
Steel A	10.5	185
Steel B	6.2	171
Steel C	3.8	158

\*Constant-pressure lathe test rating based on B1111 as 100.

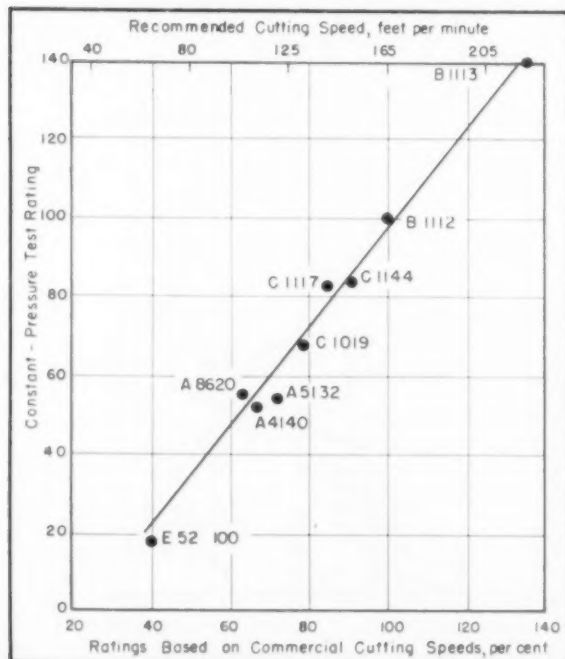
Obviously, the commercial tool-life data and the constant-pressure tests classified the steels in the same order.

Laboratory tool-life tests are commonly used to compare the machinability of steels. Steels are machined at various speeds, under standardized conditions, to determine the speed at which tool failure will occur in one hour. Superior machinability is indicated by higher permissible cutting speeds for equal tool lives. The reliability of constant-pressure ratings was checked by comparing them with data from laboratory tool-life tests. Samples of nine Bessemer steels were tested for machinability by both laboratory methods.

Fig. 4 is a cross plot of the machinability ratings, for the Bessemer steels, obtained in the two types of tests. The constant pressure tests were made on 7/8-in. rounds; the tool-life tests were made on 3-in. rounds. Duplicate samples were taken from the same ingot cuts.

Constant-pressure machinability measurements have been used most widely in testing Bessemer free-cutting steels. However, the application of the testing method is not restricted to such materials.

Fig. 5 pictures correlation between machinability ratings based on commercial practice and on constant-pressure lathe tests.



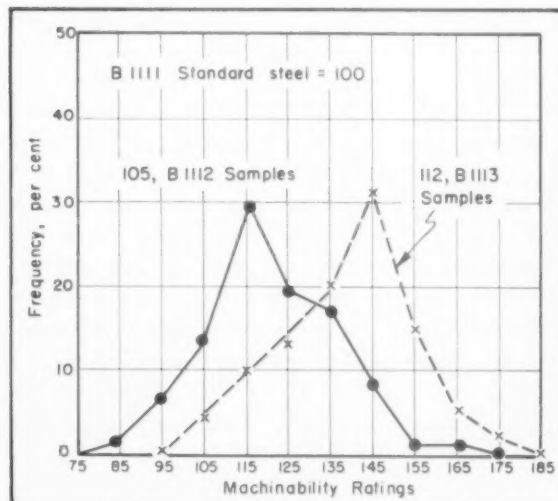
Constant-pressure machinability measurements can distinguish between low-sulphur steels differing in microstructure or composition. The lathe test can detect differences between samples of the same grade and, of course, between grades. Fig. 5 presents the constant-pressure ratings plotted against the cutting speeds recommended by a large steel company. The laboratory ratings are averages for several samples of each grade; the commercial cutting speeds are based on experience.

Laboratory tests and data assume importance when they guide successful changes in commercial practices. It is appropriate, therefore, to discuss the application of constant-pressure machinability measurements to several practical problems. A few years ago, an investigation was conducted on Bessemer free-cutting steels. The work was started because machine shops had been reporting that occasional shipments of steel were either much better or worse than normal for the grade. Consequently, a large number of samples of commercial steels were tested with the constant-pressure lathe. Some of the data obtained in these tests are summarized in Fig. 6.

The average machinability rating of the B1113 steels was 139, and the average for the B1112 steels was 122. These constant-pressure test ratings were based on the performance of a B1111 steel assigned a rating of 100. The three grades of Bessemer steel differ in machinability principally because they contain different amounts of sulphur. The specified ranges are 0.16 to 0.23 percent sulphur for B1112 steel and 0.24 to 0.33 percent sulphur for the B1113 grade.

The frequency charts in Fig. 6 show a spread in machinability ratings for either grade of steel. Variations in quality of ostensibly similar materials are characteristic of any manufacturing pro-

Fig. 6 shows distribution of constant-pressure machinability ratings for hot-rolled Bessemer free-cutting steels.



Comparison shows machinability of low silicon content with large sulphide inclusions versus high silicon content with tiny sulphide inclusions. Fig. 7 (left). Sample 105, with rounded massive sulphides, composed of carbon, 0.07; manganese 0.94; phosphorous, 0.094; sulphur, 0.200 and silicon 0.009 percent, has a machinability rating of 185 (B1111=100) Magnification 100X. Fig. 8 (right). Sample 95, with stringer sulphides, composed of carbon 0.07, manganese 0.94, phosphorous 0.093 sulphur 0.200, silicon 0.044, has a machinability rating of 132 (B1111=100). Magnification 100X.

cess. The range in machinability ratings appears quite large because they were obtained by a sensitive testing method. The laboratory machinability ratings support the shop observations that steels of the same grade can differ significantly in cutting quality. The frequency curves indicate that about one-eighth of the B1113 samples had poorer machinability ratings than the average for B1112 steels. Conversely, an equal fraction of B1112 samples had machinability ratings better than the average for the higher-sulphur grade.

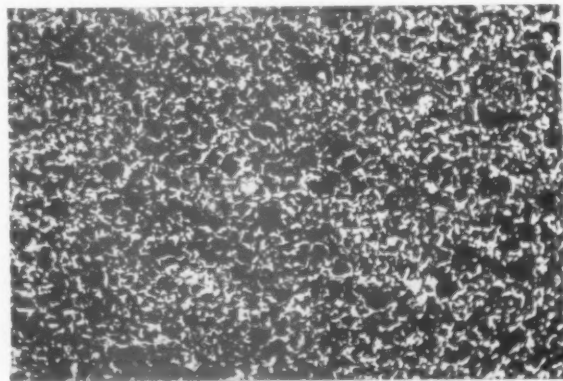
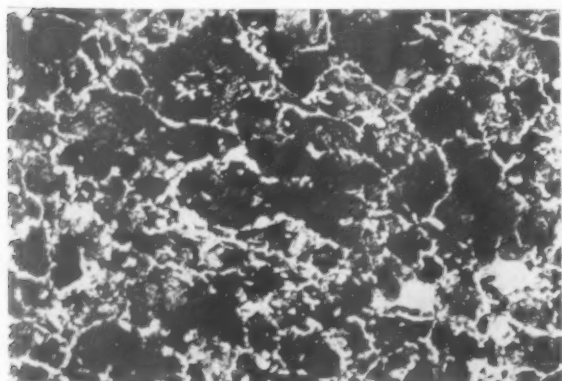
Careful metallographic examinations and chemical analyses explained the differences detected by the machinability tests. The variations in carbon, manganese, phosphorus and sulphur contents were small within either grade. That is, the production control was very good for the elements used to specify the composition of Bessemer steel. However, an important spread in silicon contents existed for steels in each grade. They varied from 0.002 to 0.045 percent in silicon content. These small differences in composition existed because there was no

reason for supposing they were important. When the test ratings were available, however, it became obvious that *machinability decreased with increases in silicon content* in the range investigated. This discovery was the basis for a patent issued on an improved Bessemer free-cutting steel (\*). This steel meets the ordinary specifications but contains less than the normal amount of silicon.

At first it was difficult to see how such small differences in silicon content could affect machinability. However, further study on the Bessemer steels showed that the size of the sulphide inclusions varied with silicon. For otherwise similar samples, higher silicon levels are associated with smaller, more elongated inclusions.

Figs. 7 and 8 illustrate the relationship between machinability rating and sulphide size or silicon content. The two samples came from different ingots of the same heat of steel. They were almost identical in composition except for the silicon content, which was varied deliberately by mold additions. The steel with 0.044 percent silicon and tiny sul-

Fig. 9. Constant-pressure lathe tests indicated that grain refinement in C1045 steel was accompanied by a decrease in machinability. A (at left) shows sample, large grain size, in hot-rolled condition; machinability rating was 58. Magnification 100X. B (right) shows sample, fine grain size, after normalizing from 1600 deg F; machinability rating was 51. Magnification 100X. Ratings were based on a B1112 steel as 100.



phides (Fig. 8) was much poorer in the laboratory test than the steel with 0.009 percent silicon and large inclusions (Fig. 7). Measurements with the constant-pressure lathe indicated that there was a difference of about 40 percent in machinability index.

Silicon is believed to affect the size of sulphide inclusions in Bessemer steels because it is a deoxidizer. Sims has shown<sup>(9)</sup> that the shape and distribution of sulphide inclusions depends on the state of deoxidation. It is probably for this reason that even small quantities of aluminum harm the machinability of steel. This fact has been known for many years, but the mechanism has not been recognized. The observation that large sulphides are preferable was verified by tests on other grades of steel. Several investigators have noted, without explaining, that machinability troubles are less common on large-diameter bars. This fits in with the results obtained on the constant-pressure lathe. The inclusions are usually larger in heavy wrought sections because they receive less deformation during hot rolling.

In addition to composition and inclusions, microstructure can affect the machinability of steel. Tests on constant-pressure lathes often distinguish between samples, of the same steel, given slightly different heat treatments. For instance, a C1045 steel was tested in the hot-rolled condition and after heating for one hour at 1600 deg F and cooling in air. The micrographs in Fig. 9 show that the grain size of the steel was smaller after heat treatment. This change in microstructure was accompanied by a decrease in machinability as measured by con-

stant-pressure tests. The machinability ratings, based on a B1112 steel as 100, were 58 for the hot-rolled condition and 51 after heat treatment.

Data obtained on a series of similar steels are summarized in Table I. All steels met the chemical and other specifications for the grade. The data are interesting, because the machinability ratings varied considerably in the as-received condition and could be changed by heat treatment.

A medium-coarse grain size seems to be desirable for easy machining of these C1045 steels. Heat treatments which coarsened the actual grain size of Steels 4, 5 and 10 resulted in better machinability ratings. Heat treatments which produced finer actual grain sizes lowered the machinability ratings of Steels 6 and 7. However, the results on Steel 9 and comparisons between the others show that the size of the pearlite grains does not correlate perfectly with the machinability ratings. Machinability ratings are apparently influenced by more subtle differences in microstructure. For example, air cooling from 1850 deg F improved the machinability ratings of another grade of 0.45 percent carbon steel regardless of the change in grain size.

Table I also shows that the machinability ratings in constant-pressure tests were not influenced very much by hardness. The ratings of Steels 6, 7 and 14 were lowered by heat treatments which resulted in lower hardnesses. In other cases, the machinability ratings varied appreciably although the hardness was not affected. Steel 14 had a remarkably poor machinability rating in the spheroidized condition. This seems to be true for C1045 steels, although spheroidization treatments benefit alloy and higher carbon grades.

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**Table I—Effect of Heat Treatment on Constant-Pressure Machinability Ratings of C1045 Steel**

Steel Number	Condition <sup>(1)</sup>	Vickers Hardness	Pearlite Grain Size (ASTM)	Constant-Pressure Machinability Rating <sup>(2)</sup>
14	As received	219	2-3	56
	Spheroidized	156	-	32
6	As received	237	0-1	55
	Heat treated	195	7	45
7	As received	236	2	52
	Heat treated	186	6	44
4	As received	193	4	42
	Heat treated	191	1-4	52
10	As received	200	6	41
	Heat treated	209	0-5	49
5	As received	188	4	40
	Heat treated	203	1	56
9	As received	204	6	40
	Heat treated	202	7	47

(1) Heat Treatments: Samples of Steels 6 and 7 were held  $\frac{1}{2}$  hour at 1550 deg F and furnace cooled to produce a finer grain size. Samples of Steels 4, 5 and 10 were air cooled after one hour at 1850 deg F to produce a coarser grain size. Steel 9 was heated one hour at 1750 deg F and air cooled. The heat treatment produced a finer grain size and wider ferrite boundaries than the original microstructure.

(2) The performance of Steel 6 in the as-received condition was used as the standard of comparison. That sample was given an arbitrary rating of 55; lower ratings indicate inferior machinability. On the ASTM scale, higher numbers indicate smaller grain sizes.

# Steel-Spring-Type Vibration Mountings for Machine Tools

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## Part I

**V**IBRATION PROBLEMS OCCUR in every field of engineering and in practically every type of plant or industry. While the presence of vibration is usually perceptible, its source is not always easily determined. There are two common types of vibration control: (1) "Positive Isolation"—preventing the transmission of disturbing vibration set up by a machine into the sub-structure on which it rests by interposing vibration control mountings between the machine and the sub-base; (2) "Negative Isolation"—preventing transmission of disturbing vibration originating from some external source into a precision machine whose operation would be affected by such vibration. This is accomplished by interposing vibration mountings between the affected machine (not the disturbing machine) and the sub-structure on which it rests.

### Vibration Hazards Vary

Since it is not always possible or practical to design machinery which will be in complete balance throughout its entire range of operation (and life), it can be expected that practically every machine containing moving parts will create vibration. Whether or not the vibration will be of sufficient intensity to become a hazard to the building structure, to personnel and adjacent equipment, or to neighboring localities can be determined only by thorough consideration of all aspects of the proposed installation.

**Reduction of Vibration Transmission:** By correct application of vibration-engineering prin-

ciples, a machine which might ordinarily cause considerable transmission of unbalanced forces if mounted solidly may be resiliently mounted with such a reduction in transmitted force that it no longer constitutes a problem. A 100-ton inclinable punch press, installed on an upper wood floor, could not be operated because it shook the whole building and even dishes in a neighboring apartment building. The installation of effective steel spring vibration isolators overcame the difficulty.

Conversely, a precision machine such as a grinder, lathe, or optical comparator can be supported on vibration-control mountings which will just as effectively prevent transmission of external vibration from punch presses, hammers, trains, etc., into the precision machines.

### Experiments on Controls

**Increased Machine Efficiency Resulting in Increased Production:** Practical experiments have indicated that a valuable portion of the energy lost in transmitting vibration to a rigid supporting structure may be saved through the use of resilient mountings. In the machine tool field this is particularly true of hammers. Fig. 1 shows the results of tests run on two identical hammers, one mounted on a spring-isolated concrete foundation, the other on a conventional non-isolated foundation. The increased blow efficiency of the spring-isolated hammer is illustrated by the greater deformation of the test sample at the right, as compared to the center sample produced on a non-isolated hammer.

In many cases, particularly with punch presses, it is impossible to operate the machines at maximum

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

speeds because the vibration becomes too severe. The use of effective vibration-control mountings prevents vibration transmission and permits increased production by making possible higher operating speeds, producing more pieces per hour.

#### **Improved Plant Layout Resulting in Increased Production and Reduced Production Costs:**

Many companies "hide" their precision finishing machines from the hammers or punch presses which perform the original forming operations. However, more and more companies are achieving straight-line production flow, putting precision finishing machines right beside forming machines to obtain greater production and reduced handling costs. This has only been possible through the use of effective vibration control. For example, the Cleveland Graphite Bronze Company has precision finished machines located right beside over 200 spring-isolated punch presses.

**Reduction of Rejects:** This benefit quickly pays for vibration isolation of such machines as precision grinders and lathes. A large portion of all rejects on precision machines is caused by external vibration. However, plant surveys have revealed numerous cases where this cause has been overlooked. With effective vibration control it is possible and practical to completely eliminate such rejects. The required isolation efficiency, and the cost of isolation, increases with the complexity of the problem. However, the installation shown in Fig. 2 demonstrates that the very finest vibration control can quickly pay for itself. This grating ruling engine has a diamond point which cuts 15,000 lines per inch on a glass surface with an accuracy of one millionth of an inch. The operation requires from four to five days in a sealed room. External vibrations so slight that the amplitude of four millionths of an inch had to be measured by interferometer methods caused expensive rejects and a complete loss of four or five days production each time it occurred. The loss was several hundred dollars. The problem was solved completely by mounting this machine on a concrete inertia block supported on four spring isolators.

**Reduced Machine Maintenance and Increased Machine Life:** Vibration and shock is the result of unbalanced forces developed within a machine. If the machine is bolted rigidly to a solid foundation, these forces must be resisted by internal stresses set up in the machine members. Such stresses frequently produce strains and misalignment which result in increased wear on dies, bearings, etc. On the other hand, if these machines are mounted on resilient supports, the forces are dissipated as the whole machine moves slightly as a unit on the mountings. The destructive effect of

external vibration and shock on precision machine tools is also prevented when these tools are protected by effective vibration control mountings.

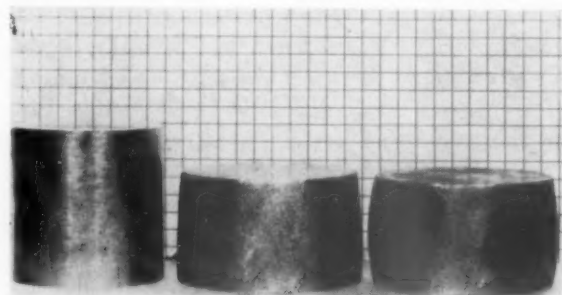
Much of the wear and failure of parts on punch presses may be due to stresses set up by the high frequency shock waves which are known to travel through impact machines. These complicated wave formations are explained in "The Dynamic Principles of Machine Foundations and Ground," a paper read by Messrs. J. H. A. Crockett and R. E. R. Hammond before The Institution of Mechanical Engineers, London, April, 1949. This study of shock wave reflections and refractions contains data on the percentage of reflection as a shock wave travels from one material into another. There is a 70 percent reflection between steel and concrete, whereas the reflection is zero between two steel surfaces. Accordingly, a stress wave travelling down through the frame of a press to the concrete floor (if it is rigidly mounted) would be reflected back with a magnitude of approximately 70 percent of the original stress. This stress then travels back through the press frame, strikes other surfaces such as the bearing surfaces, where a portion of it is reflected back and a portion of it is transmitted into the bearings. It may combine with other reflected stresses to form extremely high concentrations.

#### **Isolators Take Stresses**

On the other hand, if the press leg is mounted on steel vibration isolators, instead of the stress waves being reflected back into the press, they pass almost 100 percent into the isolators because there is no reflection between steel-to-steel surfaces. This means that the stresses are transferred into the isolators which are designed to accommodate and absorb them.

**Reduced Construction and Installation Costs:** The use of vibration-control mounting does not always reduce these costs. The cost for installing spring isolators on a hammer runs from approximately 25 to 50 percent more than an installa-

Fig. 1 emphasizes difference in hammer-blow efficiency; alloy steel slug (left); blow by non-isolated hammer (center); blow by isolated hammer (right).



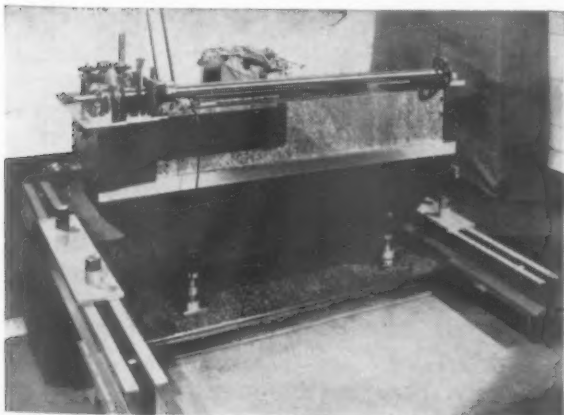
tion made on a conventional non-isolated foundation. However, the *overall* savings through the listed benefits generally warrant increased initial expenditures. Frequently the use of vibration control makes it unnecessary to go to far more extensive methods of solving a problem. At the plant of a large Mid-Western manufacturer of airplane and automotive parts, the vibration from forging hammers was found to be seriously affecting the accuracy of precision machines. Plans had been drawn up for an extensive new forge building in order to move the hammers away from the other equipment. However, it was decided to first try mounting one of the hammers on a spring-isolated concrete foundation in the old building. The results were so excellent that it was impossible to detect any transmitted vibration. This made it possible to abandon plans for the new building, and nearly a dozen hammers are now operating beside precision machines in the original building.

### Controls Help Economy

When vibration transmission either into or from a machine is discovered in a plant, one of the first thoughts is often to make major structural changes to strengthen the support. Such changes are frequently far more expensive than effective vibration control. If the vibration mountings provide sufficient deflection, they can do an excellent job even when installed on a relatively weak supporting structure.

Probably the most outstanding example of this in the history of vibration control occurred within the last few months at a huge plant in the Mid-West which is being converted to defense production. Space limitations and other factors made it necessary to install well over 1,000 high-precision machine tools such as grinders, millers, lathes and boring machines on a balcony which had never

Fig. 2. Precision ruling machine is spring-isolated to secure accuracy of 0.000001 in., ruling 13,000 lines per inch. (Bausch & Lomb Optical Co.)



been designed for such use. The operation of this plant requires the use of tow motors, lift trucks, and even tractors on this balcony. As such equipment passed even several hundred feet from the machines, the four-inch-thick floor weaved up and down so severely that it was impossible to do precision work. It would have been extremely expensive, very difficult, and of unpredictable value to strengthen this balcony which is located at least 25 feet above the main floor. It was decided to determine whether or not any type of vibration-control mountings could be effectively used.

### Provides One-Inch Deflection

In a series of tests, it was found that steel-spring isolators provided static deflections of nearly one inch in the springs and, supported on a combination of cork and ribbed rubber pads, could stop the vibration. It was possible to bring the tractors within six feet of a surface grinder taking a 0.004-in. cut on automatic feed. It was even possible to run the tractor at this distance over timbers on the floor to create maximum impact without producing the slightest flaw in the work performed by the spring-isolated grinder. The cost for even this highly efficient isolation averaged considerably less than 5 percent of the machine tool cost.

On this installation, the 2-in. thick wood blocks were removed, the cork-and-rubber pads were laid on the 4-in. concrete floor, the isolators were set on top of the pads, and the machines were fastened to the isolators by means of the isolator adjusting and leveling bolts. No foundation bolts were required into the concrete slab, and this saving alone probably paid for the isolators.

Since spring isolators prevent shock transmission into the floor, impact machines such as punch presses can be operated safely on floors which will carry only the static weight of the machines, plus a safety factor of approximately 25 percent. When designing new buildings, tremendous savings can be made through the use of lighter construction, and vibrating machinery can be safely located in existing buildings where the floor strength would not be sufficient if it were necessary to provide for shock loads.

**Improved Working Conditions:** Actual experiments have shown that excessive vibration and the noise which generally accompanies it have a decided influence on the nervous system and contribute materially to mental and physical fatigue. Such fatigue is detrimental to the health, leads to accidents, and reduces the efficiency of workers. The cost of vibration control will generally be recovered in a short time by an actual increase in personnel efficiency.

# Hobs and Hobbing in High Production

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## Part II

IN DISCUSSING THE CUTTING action of multiple-thread hobs, we shall analyze first the action of a four-thread hob, starting it in the same position of the cut as for the single-thread type.

Fig. 21 shows that we have the basic conditions to be analyzed as in the single-thread type. *R* and *S* are the hob centerlines at the beginning and end of the 0.045 in. feed. The layouts which follow correspond to the four positions *WW*, *XX*, *YY* and *ZZ*.

In making such an analysis, it is well to bear in mind that only one thread of the hob is working on a tooth space while that space is in contact with the hob. There are, of course, as many as three threads in contact with the gear, but these are working on three different spaces simultaneously. However, whatever happens to one space while it is in contact with its thread on the hob, also happens to the other tooth spaces in contact with the other threads.

Fig. 22 shows the cutting action at section *WW*. Whereas for the single-thread hob, clarity of presentation did not permit illustrating the work of each flute, we can show the action of each flute for the four-thread hob.

At *A*, the fully generated space is represented by section *WW*. Here we have just nicked the OD of the gear. The work done by the hob teeth on flutes 1, 2 and 3 as the space rotates from *B* to *A* are shown at *B*. As the space rotates past centerline *A* and out of mesh with the hob, teeth on flutes 4 and 5 will remove metal from the space in the amount shown, shaded, to the right of the hob tooth at *A*.

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

In fig. 23, the space at centerline *D* illustrates the condition preceding generation of the space corresponding to section *XX*, which is shown fully generated at *A*. Here the cut is deeper. Again material removed by individual flutes as the space is indexed from *C* to *B* is shown at *C*. Similarly the cutting action from *B* to *A* is shown at *B* for each flute. At *A* is shown the material removed after the gear space has rotated past the centerline of coincidence with the hob.

As with the single-thread hob, the heavier cuts are removed between *B* and *A*. Lighter cuts are taken after the space passes the centerline. These cuts are indicated by the shaded portions at *B* and *A*.

Fig. 24 shows the condition corresponding to section *YY*. Note at *B* that there is more equalized distribution of metal removal from both profiles than we had for the single-thread hob.

Fig. 25 corresponds to section *ZZ*, with the hob at full depth in the space at the end of the cut.

Analysis of these layouts reveals that:

- (1) As for the single-thread hob, little work is left for the hob after the space passes the centerline of coincidence between hob and gear. In both cases, the left side of the tooth space had been fully generated except for a very small amount near the fillet of the teeth.
- (2) An important point of difference is that whereas with the single-thread hob most of the work was done between the second and third linear pitch to the right of the centerline, the four-thread hob does most of its work between the centerline and the first pitch to the right.

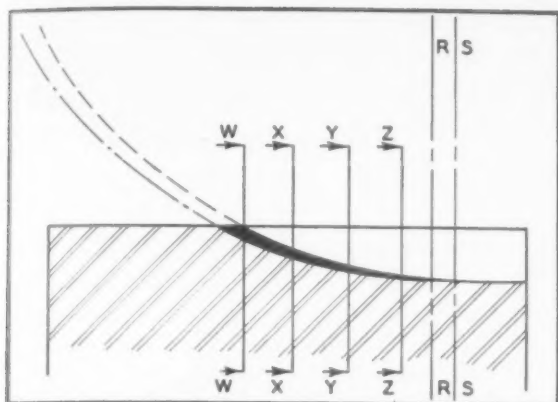


Fig. 21 presents basic conditions for analysis. *R* and *S* are hob centerlines.

- (3) Comparing the layouts shows that entering teeth of the single-thread hob are loaded more heavily and for a longer duration than those of the 4-threaded hob. The 4-thread hob teeth have a more evenly distributed chip load due to the ability of the hob to index the gear faster.
- (4) The layouts clearly show that the 4-thread hob calls for more flutes in order to obtain a smoother, more accurate, involute profile.

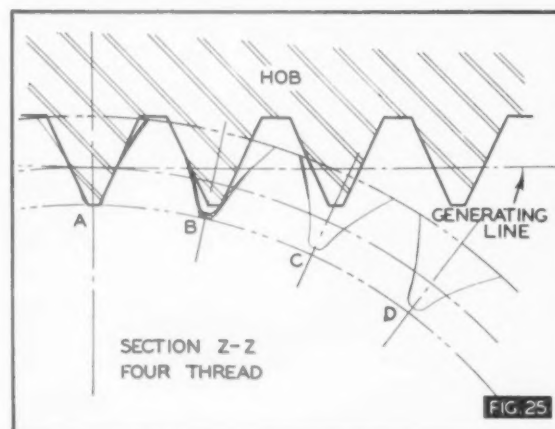
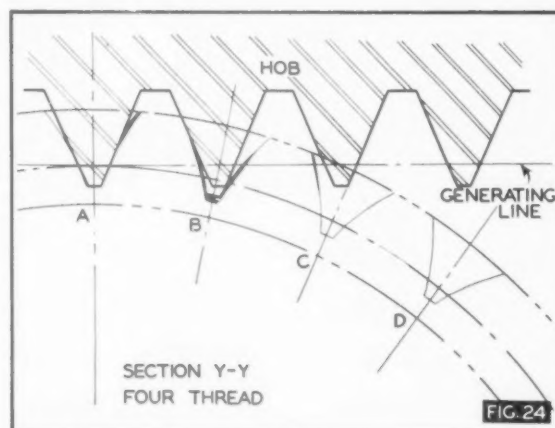
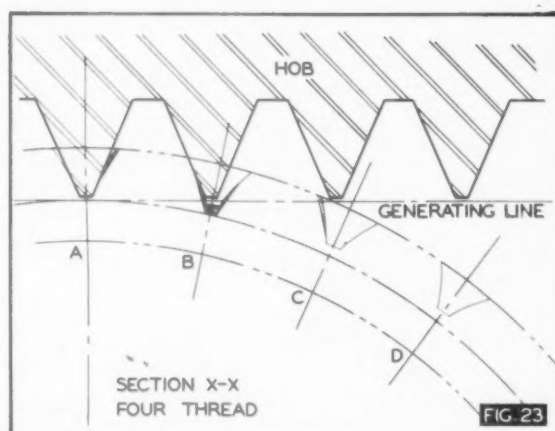
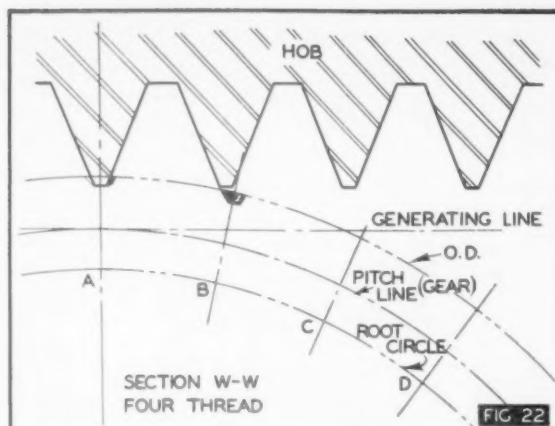
### Chip Analysis

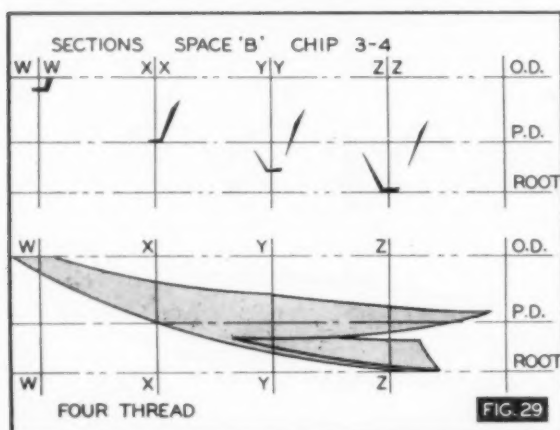
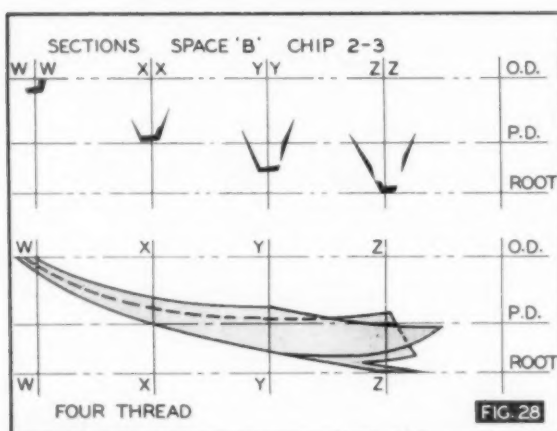
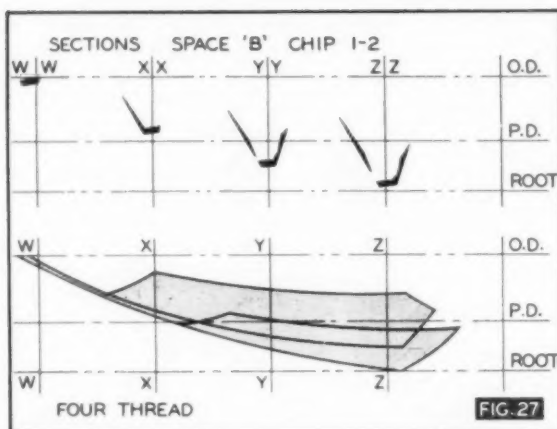
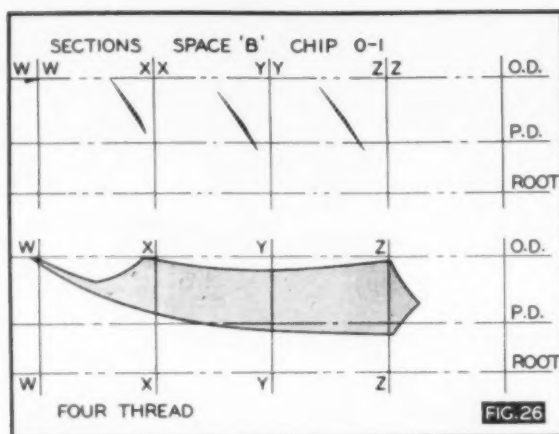
Fig. 26 shows the chip formed by flute 1 of the 4-thread hob as derived from the last 4 Figs. (22, 23, 24, and 25). At the bottom is the side view of the chip, showing its approximate shape, providing it did not curl or distort while being formed. The section of the chip at *WW*, *XX*, *YY* and *ZZ* are shown above.

Fig. 27 shows the chips formed by the tooth on flute #2 while the space rotates to centerline from the first pitch to the right. It is derived in the same manner as the chip in Fig. 26. Probably this chip would not hang together in actual practice because of the thin wall thickness near the bottom of the chip. The chip formed by flute #3 is shown in Fig. 28, and the chip formed by flute #4 during its contact with the gear space is shown in Fig. 29.

Fig. 30 shows chips formed at centerline *A* for sections *W*, *X*, *Y* and *Z*. It is presented in a slightly different manner. It shows a completed tooth space at the left. In this we have inserted the cross sections of the chips in their relative position, as they would appear in an end view of the tooth space.

Work of each flute of the 4-thread hob is shown progressively. Fig. 22 shows the cutting action at section *WW* where the OD of the gear has just been nicked. The cut is deeper in Fig. 23, illustrating work on section *XX*. Fig. 24 shows condition corresponding to section *YY*, and Fig. 25 corresponds to section *ZZ* with the hob at full depth in the space at the end of the cut.





The hob tooth forms two chips in this case, as shown.

Fig. 31 is the chip formed by the tooth on flute #2 after the space passes the centerline; Fig. 32 shows the same for flute #3; and Fig. 33, the same for flute #4.

In addition to the chips already illustrated, we also have to consider some of the smaller chips removed in generating the gear spaces. One of them (Fig. 34) is formed by the second flute while the space rotates from the second pitch to the first pitch to the right of centerline. Fig. 35 is the chip formed by flute #3 under the same conditions, and the chip formed by the tooth on flute #4 is indicated in Fig. 36. These latter chips are relatively small, however, and have little effect on the cutting action of the hob.

### Summary of Chip Layouts

Summarizing the chip layouts for the 4-thread hob, therefore, we find the following:

- (1) The 4-thread hob produced chips varying in thickness from 0.0017 to 0.0043 in. They varied in length from 0.103 to 0.742 in. The single-thread hob produced 18 thinner chips while the 4-thread hob produced 11 thicker ones, while removing the same volume of chips in the same length of time. The difference in chip length is accounted for by the difference in hob diameter, the 4-thread hob being 4 in. diameter as against 3 in. diameter for the single-thread hob.
- (2) By counting the number of hob teeth working on a given space in both cases, we find there were 30 teeth in the case of the single-thread and 36 teeth for the 4-thread, for an interval of 0.180 in. gear face width. Combining this data with the findings as to chips, both hobs have approximately equal chip loads when they cut a gear in the same length of time. Conversely, if a four-thread hob were run at the same feed per revolution of gear blank and speed as for a single-thread hob, its teeth would carry four times the chip load.
- (3) Single-thread hobs will not stand up under heavy feed as well as multiple-thread hobs because of the higher concentration of load on a small portion of the tooth, in this case the upper left corner. Had we used a  $14\frac{1}{2}$  deg pressure angle instead of  $27\frac{1}{2}$  deg, the

Fig. 26 shows chip formed by flute 1 of the 4-thread hob; side view at bottom shows approximate shape. Fig. 27 shows chips formed by tooth of flute 2 while space rotates to centerline from first pitch to the right. Fig. 28 pictures cross section and side view of chip formed by third flute, while Fig. 29 gives similar views of chip formed by flute 4 during its contact with gear space.

corner loading would have been even more pronounced. In practice, a single-thread hob would not stand up under the 0.180 in. feed used in the example. In the case of the 4-thread hob, the rapid indexing of the gear quickly carries the corner of the hob past the critical zone, thus distributing the load around the hob tooth to better advantage, which permits its use for 0.045 in. feed, or the equivalent of 0.180 in. feed for the single-thread hob.

In general, it can be said therefore that multiple-thread hobs should not only give increased production, but should show a generally improved tool life because of the better chip loading conditions.

### Protuberance Alters Problem

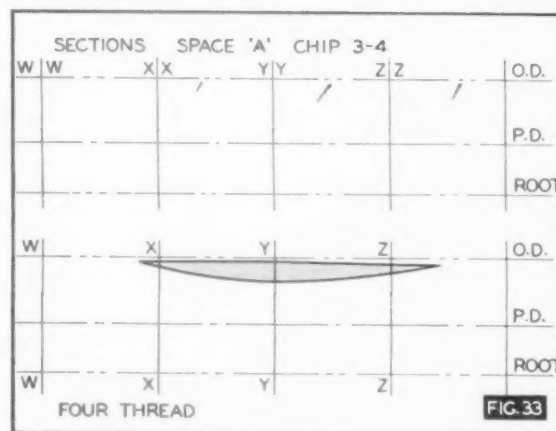
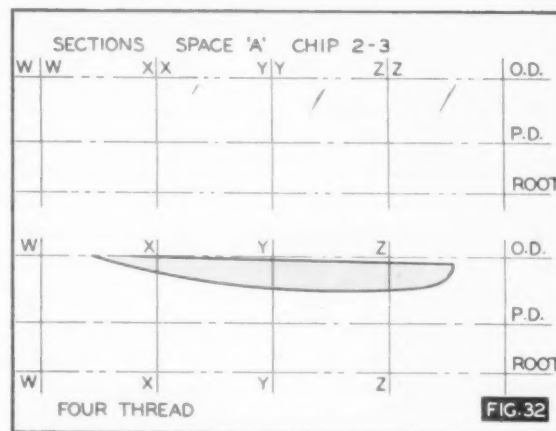
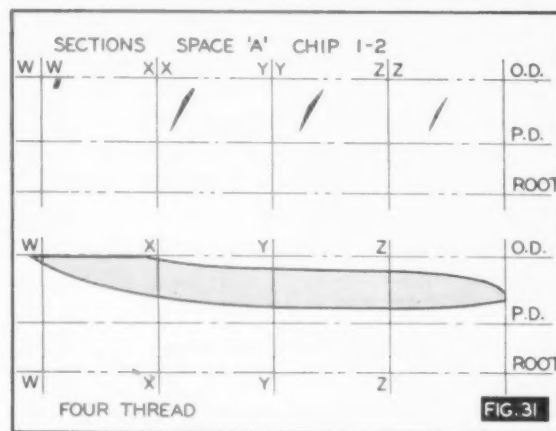
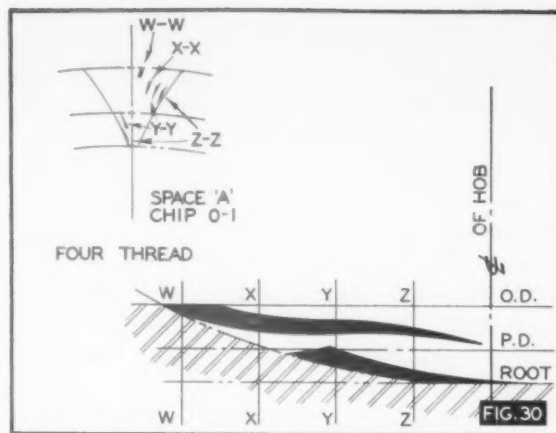
The corner loading of hob teeth just discussed, and the heavy loads imposed in the cutting zone, become particularly important when hobs with protuberances are used either prior to shaving or prior to gear profile grinding.

Addition of a protuberance reduces side clearance at the tip of the hob. Wherever possible, the minimum side clearance should be kept to  $2\frac{1}{2}$  deg or more. It is easy enough to calculate the reduced clearance from the amount of relief cam used and the new pressure angle formed by the protuberance. Actually, when a protuberance is added to a hob, the amount of cam relief should be increased to compensate for the lower pressure angle. In this way, the life of protuberance hobs can be increased to where they will perform on a basis more comparable to a standard hob.

There are instances, of course, where increase of backoff cam will not give sufficient side clearance to the protuberance. In such cases, it is well to use a large radius at the tip of the hob as shown in Fig. 37. This radius should be made practically tangent to the protuberance. Then if the protuberance is run parallel to the pressure angle for a short distance, as at B, the protuberance will stand up better. This is due to the fact that the crest of the protuberance and the radius will cut a natural clearance for the short angle used to join the protuberance to the flank of the hob tooth, as at C.

The chip formation layouts in Fig. 38 also reveal the reason for another condition that sometimes comes up. Occasionally hob users find that teeth pop out of right-hand hobs. Fig. 38 shows a hob in position for grinding which is inverted as compared

Fig. 30 shows chips formed at centerline A for sections W, X, Y and Z. Cross sections of the chips are shown, in their relative positions, inserted in completed tooth spaces at left. Figs. 31, 32, and 33 picture chips formed by teeth on flutes 2, 3 and 4 respectively, after the spaces have passed centerline.



to layouts shown previously. This occurs at practically any time during their life, not necessarily when they have been ground down fairly thin. Similar left-hand hobs, on the other hand, would give no trouble until completely worn out.

The solution to the problem was simply to reverse the direction of rotation of the grinding wheel when sharpening right-hand hobs.

In grinding, more heat is absorbed as the wheel leaves the face of the tooth than at other times. The more acute the angle, as with multiple-thread straight-gashed hobs, the slower the heat dissipation and the greater the chance for setting up strains on the left side in right-hand hobs near the root of the hob teeth.

A study of the layouts shown also reveals that the left side of the hob tooth is under tension, while the other side is in compression. Reversal of the grinding wheel simply put any grinding strains on the opposite or compression side of the tooth, where they could have little effect. When this was done, the right-hand hobs performed just as well as the left-hand hobs.

### Spiral Gashed Hobs Used

The layouts of chip formation also reveal clearly why spiral gashed multiple-thread hobs should be used whenever the thread angle is appreciable, or over 4 deg. True, straight gashed hobs do expedite hob sharpening, but this gain is at considerable sacrifice in hob performance.

If a straight gash is made in a 4-thread hob, there is an acute angle at the position of the hob tooth requiring the greatest strength and backing both to support the chip load and to conduct heat away. The acute angle in our example would amount to 6 deg 9 min., the difference between the thread angle and the gash if it were straight. For coarser pitch hobs, the problem increases sharply. A 5-pitch 4-thread hob  $4\frac{1}{2}$  in. in diameter would have an angle of 15 deg 16 min. At the same time the other side of the tooth would have the face angle of the hob teeth cut down to an equivalent obtuse angle, a condition also unfavorable to good

performance.

The layouts also revealed an interesting fact with regard to automatic hob-shifting devices. The question arises at different times as to the best direction in which to shift a hob. Usually the answer has been secured empirically in each case by experimentally shifting the hob first one way and then the other, until best hob life and gear accuracy were obtained.

### Hobs Shift For Work

The layouts, however, show that the correct direction of shift is the one which will permit a fresh portion of the hob to be located on the centerline of coincidence, i.e., the point where most of the actual finish involute profile is generated. For instance, in the example we have been using, the hob should be shifted from left to right.

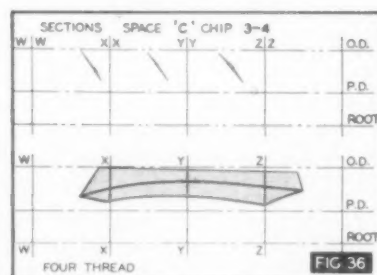
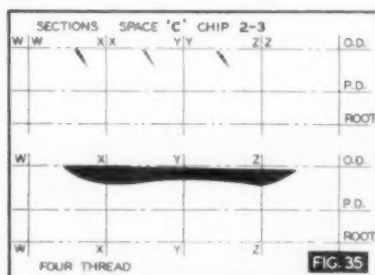
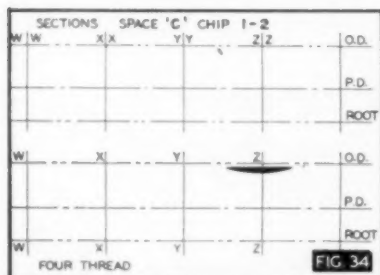
If a left-hand hob had been used it would have been necessary to reverse the direction of hob shift, from right to left, to assure that a fresh portion of the hob will be in the finishing zone of the hob. This, as mentioned, is at the centerline of coincidence.

Fig. 39 is a close-up view of one type of chip obtained while conventional hobbing, from the 4-thread hob. It clearly illustrates the similarity between groups of chips which enabled us to identify and segregate the types.

Fig. 40 is a close-up view of one type of chip, obtained while climb hobbing, under the same conditions as for the chips in Fig. 39. Comparison between the two, shows the conventional cut chip to more clearly resemble a chip obtained by our layouts because it is not compressed to the same degree as the chip now being considered.

When time permits, we hope to complete our analysis. We have reason to believe that a study of the chips themselves will not only confirm our general findings obtained through layouts, but will also reveal further interesting data by comparing the tool marks and scuff marks on the chips obtained respectively by climb cutting and conventional hobbing.

Some of the smaller chips removed in generating the gear spaces are indicated in Fig. 34 which shows that formed by second flute while the space rotates from second pitch to the first pitch to the right of centerline. Fig. 35 shows the chip formed by the third flute under the same conditions. Fig. 36 pictures the chip resulting from same conditions for flute 4.



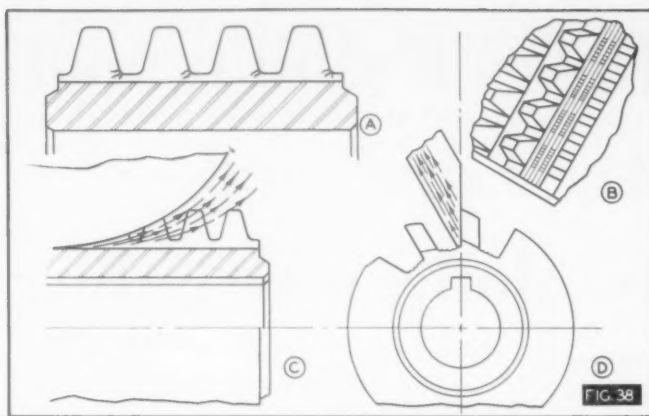
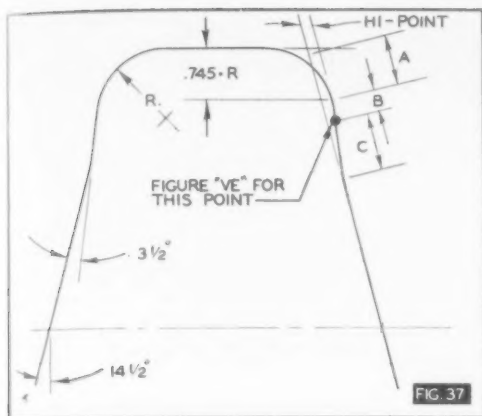


Fig. 37. Large radius at tip of hob provides sufficient clearance for protuberance hobs, insuring better performance and life. Fig. 38. Hob in position for grinding; shown inverted as compared to previous illustrations.

In concluding, a few remarks are appropriate at this time with regard to hob steel and heat-treatment of hobs.

### Checking and Controls Needed

Obviously, complete understanding and cooperating between hob maker and steel producer is essential. But this cooperation should be supplemented with definite controls. Correct chemical composition can be readily checked and maintained through use of proper equipment designed for use with high-alloy steels as used in hobs. Physical metallurgy must be watched through ingot, billet, forging, annealing and final heat-treat stages to insure correct performance.

A useful practice is destructive spot checking on hob forgings to inspect carbide segregation, porosity, etc. Leaving of incomplete teeth on a hob for removal after hardening to determine microstructure has also been a helpful practice. It is always sound practice to subject tools to metallurgical inspection when they have either performed exceptionally well or have failed.

When proper controls are applied in processing, molybdenum high-speed steel (M-2) hobs perform equally as well or better than hobs made of T-1

tungsten in most cases. M-2 hobs harden just as well as those of T-1 steel when modern salt bath heat-treating equipment is used, properly controlled. Furthermore, the souped-up molybdenum steels may be hardened in such a manner as to effectively replace the so-called "shot-in-the-arm" tungsten steels.

What constitutes correct heat-treatment depends considerably on the specific application. When hobbing cast iron we need ability to resist abrasion primarily. When cutting mild steel, we need shock-resisting qualities, with somewhat less stress on the ability of the hob to resist abrasion. When machining high-alloy steels in the high carbon range, we need as much of both as possible and must obtain the best compromise.

Again, machine conditions within a hob user's plant dictate to some extent how the tools should be hardened. If hobs are misused due to poor machine conditions or abuse from the machine operator, it is better to harden the hob to withstand some extra shocks at the expense of good cutting ability. This means that, in getting the maximum efficiency when hobbing, the hobs must be made right, they must be used correctly, and the production parts must come to the machine in the correct condition.

Fig. 39. Close-up view shows chips obtained from a 4-thread hob with conventional hobbing.

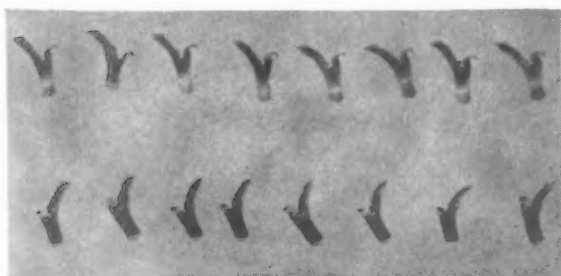
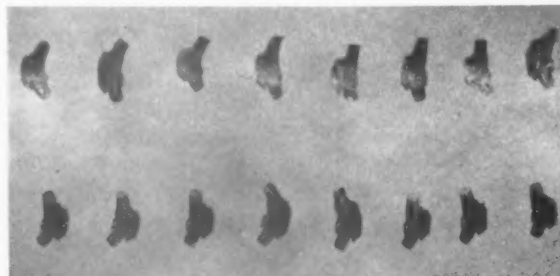


Fig. 40. Type of chip obtained while climb hobbing; chips are more compressed than in Fig. 39.



# How Flexibility and Safety Are Combined In Modern Grinding Wheels

By Robert A. Green

ABRASIVE ENGINEER  
BAY STATE ABRASIVE PRODUCTS CO.

THE STORY OF THE synthesized grinding stone, called then the "emery wheel", dates back to around 1864. From this early date until today, the quest for stronger and safer wheels has continued. In further recognition of the fact that standards for safe and sane operation of wheels and machines should be adopted, the Safety Code for the use, care and protection of abrasive wheels was drawn up and accepted by the abrasive industry in general.

The fact that limitations must be placed on the operating speed of the grinding wheel has been recognized for some time. The most widely used wheel in the first part of the 20th Century was the vitrified grinding wheel. It was soon established that for optimum operating conditions (a combination of fastest rate of stock removal, best life and safe operation), the most desirable operating speeds for the vitrified wheel were between 5000 and 6000 surface feet per minute, certainly in the best interests of safety, not over 6500 sfpm.

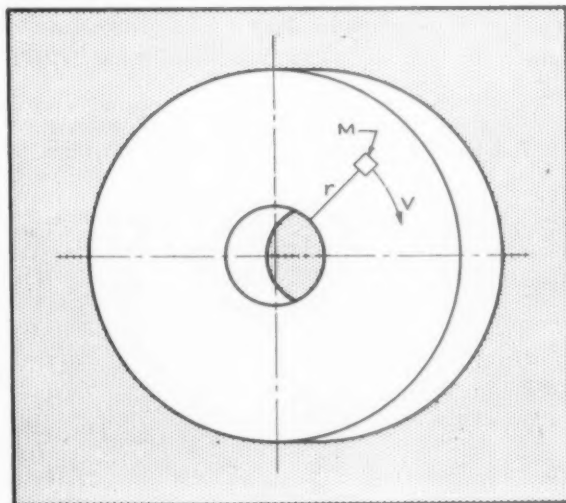
It may be well to consider for a moment some of the early attempts to reinforce the vitrified wheel. Many methods of flanging the wheel were introduced; some to prevent fragmentation of the wheel, others to strengthen the wheel against breakage. Generally accepted was the fact that the tapered wheel, tapered from a diametrical flat on both sides to the rim or face, was safer than the "straight" wheel. By resorting to simple dynamics, it can be shown to be a reasonable assumption. Gammeter and plate-mounted wheels were developed for the twofold reason of ease of mounting and safety. However, because of the nature of the processing of the vitrified wheels exemplified by high temperature kiln firing, no economically successful means of internally reinforcing vitrified wheels was, or has been, developed.

In the first quarter of the 20th Century, the most

radical development affecting safety in abrasive wheels was the introduction of the phenolic resin bonded wheel. As previously stated, the generally accepted operating speed of wheels up to this time was 5000-6500 sfpm. After much research and development, it was established that the resin-bonded wheel could be operated at surface speeds up to 9500 sfpm with the same margin of safety for a certainty. From a production point of view, the resin bonded wheel was to the vitrified wheel as the carbide tool was to the high-speed or tool steel tool. By increasing operating speeds, corresponding increases in the rate of stock removal were obtained. Furthermore, due to low baking temperatures, it now was possible to add to the resinoid wheel some type of internal reinforcement.

By consulting various sources to establish tensile strength figures for ceramic and resinoid bonds,

Fig. 1. Drawing presents visually, formula which makes the safety factor available in these wheels.



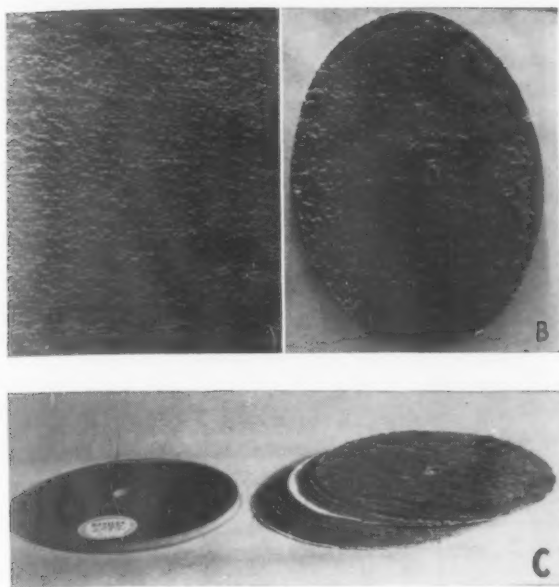


Fig. 2A shows raw abrasive impregnated cotton fibre stock; B pictures coated stock; and C shows unpressed "assembled" flexible type wheel with the resultant product.

a wide variation in strength is noted. However, for pure bond unadulterated by grain, representative tensile figures might be 500-3000 psi for porcelain bonds, and 3500-9000 psi for resin bonds. These figures do not tell the whole story regarding increased operating speeds for resinoid wheels, but, these, plus elasticity values, bond strength and other factors, indicate directly why higher operating speeds are possible.

With the higher operating speeds, the grinding wheel manufacturers turned their research to the thought of increasing safety. All possible means of reinforcement to prevent fragmentation were considered; some of which were fine mesh screen, various cloth materials and steel rings. The steel ring is widely used today as a reinforcement in resinoid snagging wheels of all shapes and is probably the most satisfactory. Varying degrees of success were achieved temporarily with the other types of reinforcement.

To illustrate one of the many forces acting on a grinding wheel, here is a dynamic formula which demonstrates the safety factor available in a wheel tested and shipped by a manufacturer. The formula

$$F = \frac{MV^2}{r} \text{ (see Fig. 1) where}$$

$M$  = mass under examination

$r$  = distance of mass from center of revolution

$V$  = linear velocity of mass

will yield the radial force ( $F$ ) along  $r$  which must be present to prevent the mass from flying into space. Or this force  $F$  is roughly in proportion to the (bond) strength. As is common practice, most manufacturers speed test their wheels at  $1\frac{1}{2}$  times

the recommended operating speed. Therefore, at a given recommended speed the force is  $F = \frac{MV^2}{r}$

and the given test speed the  $F^t = \frac{MV_t^2}{r}$  and the re-

lation is  $\frac{Ft}{Fr} = \frac{Vt^2}{V^2}$  is proportional to  $\frac{\text{RPM}_t^2}{\text{RPM}_r^2}$ . The

rpm varies from 100 percent recommended to 150 percent tested or  $\frac{Ft}{Fr} \times \frac{(1.5)^2}{(1)^2} = 2.25$ .

This "bond strength safety factor" of 2.25 is then, for a certainty, in the tested wheel. Running wheels to destruction, it has been found that speed 200 to 300 percent of recommended operating speed may be attained which indicates a possibility of "bond strength safety factors" of 4 to 9.

Working backward from the above theory, let us consider the fact that the resinoid bonded wheel raised operating speeds roughly 50 percent from 6000 to 9000 sfp. Yet the bond strength is seen to be roughly doubled. In order to double the operating rpm, the bond strength would have to be quadrupled if an equivalent factor of safety were to be maintained.

The various reinforcements that may be placed in grinding wheels offer several opportunities to take present standard bonds and to artificially increase the "strength" of a wheel. It is well to add here that the bursting force is not the only force presented to a wheel in operation. Any unusual side force on a wheel running at 3400 rpm presents 3400 reversals of stress upon that wheel per minute, taxing the bond's endurance limit.

The scope of cut-off wheels was greatly enlarged by the development of resin bond. For years rubber and resin bonded cut-off wheels had been run at 9000 to 16,000 sfp, but, due to the thinness of the wheel, had constantly present the danger of

Fig. 3. "Cutaway" of resinoid reinforced "hat" wheel shows combination of resinoid and string from which it derives strength and safety.



breakage. It is in this field of thin resinoid bonded wheels that the manufacturer has made great strides in the last ten years.

In the early '40's the theory was conceived of reinforcing each grain or containing it in a matrix of cotton fibres in order that it may be finally bonded. The culmination of the efforts in this field resulted in Bayflex, MX, etc., and similar trade name products. Basically, this product is manufactured from many layers of cotton fibre abrasive impregnated sheets. (Fig. 2a). A resin bond is used, which, under the manufacturing process, thoroughly diffuses throughout the wheel. (Fig. 2b). The resulting product is a homogenous mass of pressed cotton-fibres, resin and evenly spaced abrasive particles, which particles are reinforced in position by the fibres. (Fig. 2c). Wheels made from the above material can be pressed to a minimum thickness of  $\frac{1}{16}$  in. An amazing amount of flexibility is thus obtained with a maximum amount of safety. The improvement in this type of wheel shows up in its inherent safety factor while the operation is at speeds of 10,000 to 15,000 sfpm.

#### "Hat" Wheels Introduced

With the introduction of the fibre-abrasive wheel, activity in the field of thin reinforced wheels intensified. Thin "hat" wheels or "depressed center" wheels were introduced for use on portable tools. In particular, this item was accepted in industry due partially to the fact that an increase in operating speed was possible due to increased safety.

As a result of the groundwork already laid, Bay State Abrasive Products Co. reinforced laminated resinoid wheels, such as Saf-T-Cut and Norton's Norflex, etc., were developed. A search for proper reinforcement materials was precipitated by this development. A reinforcement should not hinder the cutting action of the wheel yet must have a high residual strength. Again the gauntlet of cloth reinforcements was run, but this time nylon and glass fibre had been added to the list. Either of these materials has the properties of dissipation at grinding temperatures (either by heat or abrasion) yet both have a high tensile value. The reinforced laminated resinoid wheel has not the resilience of the cotton fiber abrasive wheel, which, in many instances, is a point in its favor, still it resists breakage as well and possesses higher resistance against fragmentation.

Some of the common properties of the various reinforcements are as follows: the tensile strength of nylon and fiber glass is between 20,000 and 30,000 psi (steel is given as 30,000 to 60,000 psi.) The cotton fibers are about 10,000 psi. Both cotton and nylon have relatively low ignition points and, therefore, will disappear at grinding temperatures when used properly. Glass fiber, on the other hand,



Fig. 4 Typical application of the raised hub disc, smoothing mild steel welds.

has a high ignition point; combustion is not self-sustaining, therefore, it is abraded away in a grinding wheel.

The unusual qualities of the above materials have found them a place, literally, in the grinding wheel. The use of the various materials as reinforcements has given the manufacturer an additional safety factor which can be used in two ways. One is to raise operating speeds on certain reinforced items and yet maintain a safety factor comparable to that of other products. The other is to maintain operating speeds compatible with equal wheel size in other products insuring an improved factor of safety at that speed.

The particular field of application of the reinforced "thin" wheel to date has been on those operations where grinding hazards are greatest. (Fig. 4). The outstanding example is probably the cut-off wheel where the operator manually feeds the work into the wheel, thus leaving himself exposed to the danger of breakage. Risers up to 6 and 8 in. in diameter have been half-cut and then twisted with the wheel in the cut stopping the machine but not causing a breakage.

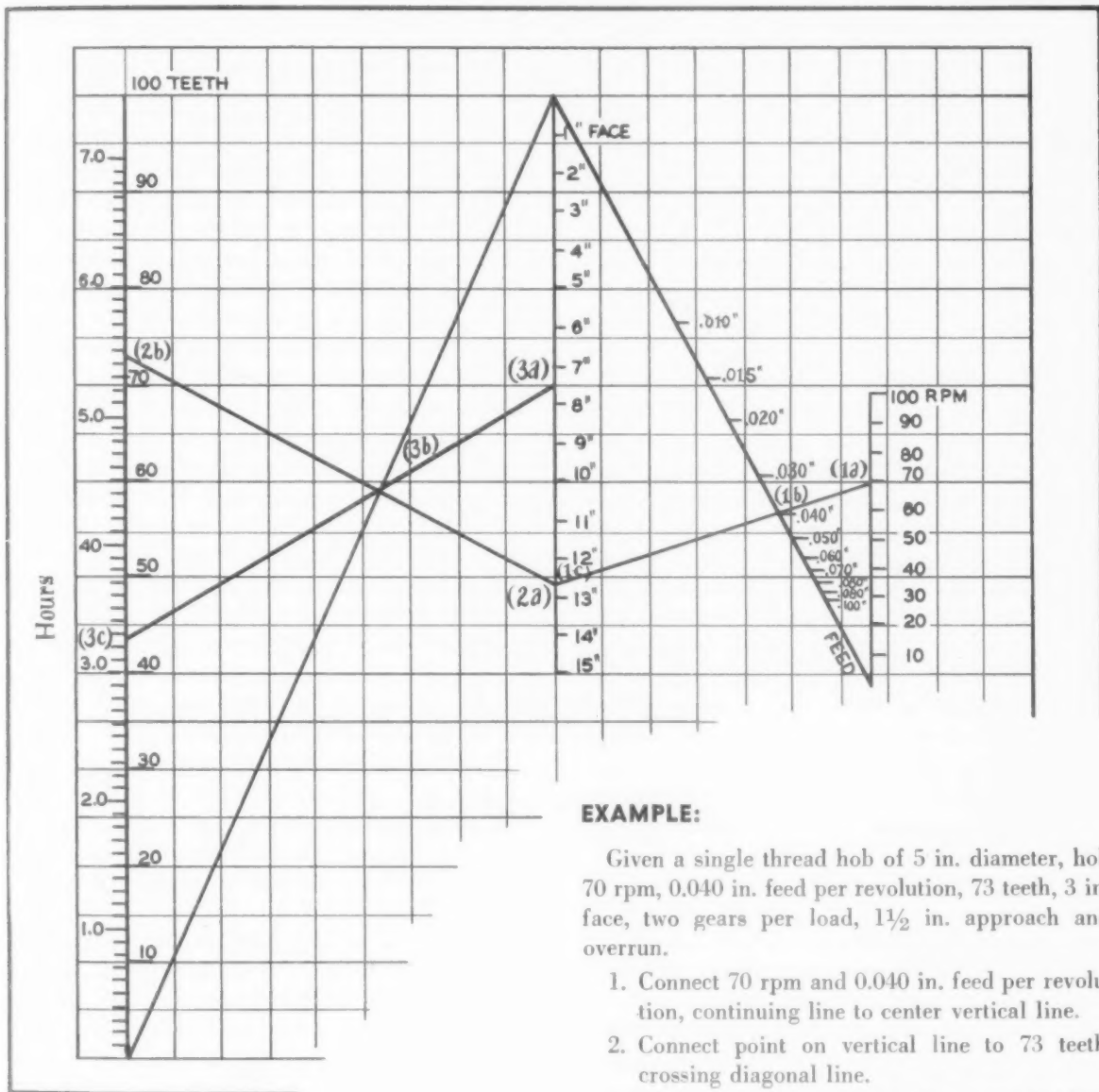
The largest field of operation has been that in which the "hat" or "depressed center" wheels have found applications as well as straight wheels 6 in. in diameter and under. "Hat" wheels are widely used for snagging welds, torch cuts, cast iron, brass, aluminum, etc., with increasingly new uses being found almost daily.

While all the mechanical means of strengthening wheels are being exploited, the industry is constantly searching for stronger basic bonds. It may be well to insert a word of caution here. All efforts in the field of reinforcement are to produce only a wheel that is less apt to break. The unbreakable wheel does not exist and is only the product of one's imagination such as the immovable object and irresistible force.

# Estimating Hobbing Time

By James W. Duffy

ALLISON DIVISION OF  
GENERAL MOTORS CORPORATION



1.0 Hours = 13.3 Spaces  
1 In. of Face = 4 Spaces  
10 Revolutions = 3 Spaces

**FORMULA:**

$$\frac{\text{Teeth} \times (\text{Face} + \text{Hob Approach and Overrun})}{\text{Feed Per Revolution} \times \text{Hob RPM}} / 60$$

**EXAMPLE:**

Given a single thread hob of 5 in. diameter, hob 70 rpm, 0.040 in. feed per revolution, 73 teeth, 3 in. face, two gears per load, 1½ in. approach and overrun.

1. Connect 70 rpm and 0.040 in. feed per revolution, continuing line to center vertical line.
2. Connect point on vertical line to 73 teeth, crossing diagonal line.
3. Pivot on diagonal line and connect hobbing face width (7½ in.), reading total hobbing time in hours and tenths of hours at the extreme left.

If a multiple thread hob is used, divide the number of teeth to be hobbled by the number of threads in the hob and use this value as the number of teeth.

# Production Evaluation of Cutting Tool Materials

By Thomas Badger

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WESTINGHOUSE ELECTRIC CORPORATION

## Part II

**C**AST ALLOYS ARE NOT steels, because iron is present only as a minor alloying element, or as an impurity. All cast alloys are principally a mixture of tungsten, chrome, and cobalt in a variety of percentages.

Cast alloy cutting materials are frequently referred to as "mid-range" materials, and this name is very appropriate. This is so because, in both cutting efficiency and in physical properties, the cast alloys are midway between the high-speed steels and the carbides. As an illustration of this "mid-range" cutting efficiency, if in a certain machining application it is known that 100 fpm is the correct cutting speed when using high-speed steels, a cast alloy tool can be substituted and the cutting speed can be set at approximately 200 fpm for the same tool life. The same feed can be used with cast alloy tools as with high-speed steel tools, so it is obvious that a cast alloy tool will remove metal about twice as fast as will high-speed steel tools. If a carbide tool were substituted on this same operation, the cutting speed could be from two to three times faster than with cast alloy tools, but it would be necessary to reduce the feed about one third. This means that the metal removal efficiency of cast alloys is about midway between high-speed steels and carbides. If, for any reason, it is impossible to use carbides on a job, cast alloys should be tried before reverting to high-speed steel tools.

Cast alloy cutting tool material is essentially a hard, nonferrous alloy of chromium, tungsten, cobalt, and carbon, and contains small amounts of one or more of the strong carbide-forming elements such as molybdenum, boron, tantalum, or vanadium. These elements are combined in varying proportions by the several suppliers of this type

of material. Chromium is used in proportions varying from 15 to 35 percent, tungsten from 15 to 25 percent, and cobalt from 40 to 50 percent. In general, this part of the alloying elements may be considered as the matrix portion whose task is the bearing of the hard carbides. It is characteristic of this matrix that it retains its hardness even at high cutting temperatures and continues to hold the carbides tightly in the solid solution of matrix metal. As in all cutting tool materials, from carbon tool steel through high-speed steel to the sintered carbides and on to the diamond itself, the cutting properties are imparted to the material by the carbide crystals. Carbon is usually added to the alloy in proportions of 2 to 4 percent. More carbon will pass into solution if the cast alloy is carburized. Such carburizing results in an increase in metal removing ability of approximately 10 percent. Such treatment, however, is not recommended, as the original brittleness of the cast alloy is too greatly increased.

Actually, to produce any specific grade of cast alloy, a very close control of the percentage of each element is required, but the user viewing the hundreds of compositions available is liable to conclude that the material is a metallurgical hash.

Cast alloy material for single-point cuttings is regularly obtainable in the form of square tool bits, available from 3/16 in. up to 1 in. square; rectangular bits, available in rectangular sections 1/8 x 1/2 in. up to 3/4 x 1 in. sections; and round bits, available from 1/8 in. up to 1 in. diameter. Finished and cast alloy tips are available in sizes for tipped single-point tools used on lathes and other similar types of machine tools.

These tips and tool bits are formed to the desired shape by pouring the molten material into chill or refractory molds. The bottom and sides of the cast piece have better cutting properties than the top and interior of the cast section. Cast alloys

Presented at Annual Meeting, American Society of  
Tool Engineers, March 15, 1951.

While casting is the basic method of forming, as might be inferred from the name "cast alloys", grinding to shape, cutting off with abrasive cut-off wheels, and certain limited machining with carbide and diamond tools is possible. Cast alloy tool materials are not heat treatable, nor can they be forged, upset, or drawn. Tool bits are slab ground on all sides and the end opposite the gate end is prepared by grinding a nominal relief angle. Finished tipped tools are prepared by brazing the tip to the shank. In about 90 percent of the usual machining applications silver brazing is recommended. In the other 10 percent, bronze brazing or the use of the higher-melting-point silver alloys is advisable. The cast alloy will not be damaged if heat necessary to melt the brazing material does not exceed 1750 deg F. On cooling to room temperature the cast alloy will return to its original hardness.

**Hardenability:** Cast alloys have absolutely no hardenability in those grades used as tool materials. The only method of hardening a cast alloy is in the chill produced in pouring the melted metal into a cold mold. After the grain structure has once been formed by this chill, no heat treatment short of remelting and repouring is effective. However, temperatures in excess of 1800 deg F. will "burn" cast alloys and reduce their cutting efficiency. The effect of cross sectional size is so noticeable that the industry considers it impractical to cast sections for cutting tools over 1 in. square.

Surface hardness of the cast alloys may be somewhat increased by nitriding. Tests on a number of small tools,  $\frac{3}{8}$  in. square, indicate that nitriding increases metal removal ability approximately 10 percent. While the exact reason for this phenomenon has not been clearly established, the most plausible explanation is that nitriding affects the grain structure, developing a finer grain on the cutting surfaces. Nitriding is especially recommended for tools having a  $\frac{3}{4}$  in. square section or over, and for form tools.

**Shear Strength:** Only fair and much lower than high-speed or "C" tool steel. This lack of strength can largely be overcome in a cutting tool by providing proper support to the cutting edge.

**Compressive Strength:** The compressive strength is very much greater than steel, but less than that of carbide. This good compressive strength is combined with a shear strength that is again superior to carbides, but inferior to high-speed steels. To do its best work as a cutting tool material, its excellent compressive strength must be utilized by supporting or backing up the cutting edges to protect them.

**Toughness:** Fair. Cast alloys are very brittle

Properties	Westinghouse Grade	Application	Speed-Feed Range
Increasing Toughness ↓ Increasing Hardness ↑	WD	Precision boring or other extremely light cuts	400-1100 fpm; 0.001 - 0.010 in. feed
	WF	Continuous light cuts	300-800 fpm; 0.002 - 0.010 in. feed
	WK	Continuous cut General purpose	200-500 fpm; 0.006 - 0.020 in. feed
	WN	Heavy continuous cuts Light interrupted cuts	175-300 fpm; 0.010 - 0.045 in. feed
	WE	Extremely heavy cuts Interrupted cuts	90-225 fpm; 0.015 - 0.045 in. feed
	WE Negative Rake	Severe interrupted cuts Machines in poor repair	90-225 fpm; 0.015 - 0.045 in. feed

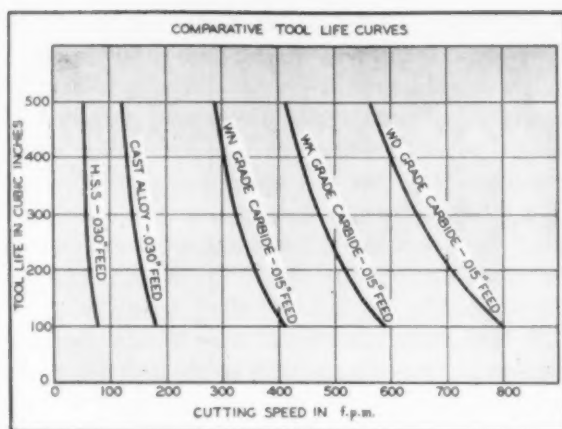


Fig. 1 shows comparisons between a high speed steel, a cast alloy and three grades of carbides.

when compared with high-speed steel of comparable hardness. Edge toughness tests indicate that the toughness of most cast alloys when fractured by impact on an edge ground to 45 deg. is only about one-sixth that of high-speed steel. However, the edge toughness of cast alloys is considerably higher than the carbides. Cast alloys are difficult to use on heavy interrupted cuts without resorting to negative rake grinding or special support.

#### Ease of Fabrication into Finished Tools:

Cast alloys are unforgeable, unweldable, and unmachinable except by grinding. It is possible to braze cast alloys to steel, and this permits making composite tools having the superior red hardness of cast alloys and the superior strength and resistance to shock of plain carbon steels. The coefficient of expansion of cast alloys varies with the composition, but in general this coefficient is very close to the value of that for steel. Because the coefficient of expansion of a cast alloy tip and the steel shank are so close, brazing strains with tipped cast alloy tools are negligible. However, cast alloys are easily cast to intricate shapes. Cast alloys are easily ground with either an aluminum oxide, silicon carbide, or diamond wheel.

They may be satisfactorily ground on equipment used to sharpen high-speed steel tools. They can also be ground with the identical equipment and wheels used for carbides if a carbide grinding set-up is available. Expensive diamond wheels are not actually required, although they may be used if available. Cast alloys will withstand more grinding abuse than any other cutting tool material. Cast alloys take a good cutting edge, good enough for any but specialized purpose tools. However, the granular nature of cast alloys makes the cutting edge susceptible to minute chipping in service, but this condition is not serious in many cases.

**Influence of Section Size on Cutting Properties:** The cutting efficiency of a cast alloy tool

seems to depend on the structure of the carbides produced by the chill, but these carbides are so complex they have never been identified. It is known that a severe chill produces the most desirable qualities, and that the best properties are attainable in section sizes of  $\frac{3}{4}$  in. or smaller. This suggests that greatest efficiency would be possible with a cast alloy tipped tool, as the tip could be cast in a small section size for greatest cutting efficiency and the steel shank used to supply the strength and toughness lacking in cast alloys. A recent cutting test showed a  $\frac{3}{8}$  in. tool to be about 5 percent more efficient than  $\frac{3}{4}$  in. tool, and a tipped tool with a tip of  $\frac{5}{16}$  in. thickness was about 5 percent more efficient than the  $\frac{3}{8}$  in. tool.

**Practical Design Considerations:** The fact that cast alloys can be cast opens many design possibilities for tools such as intricate form tools. In any design it is necessary to compensate for cast alloys' lack of strength and toughness by adequately supporting all weak sections. Any design must eliminate the necessity for any machining except finish grinding.

**Cost:** The cost of cast alloys per pound is considerably higher than that of high-speed steel, but cast alloys are usually used in small section sizes.

**Summary:** The disadvantages of cast alloy tools have been mentioned. The advantages will be summarized here. Cast alloy tools can be used:

- On old machines not suitable for carbides.
- At 100 percent higher speeds than high-speed steel tools.
- For shock conditions too severe for carbides.
- With no investment in special grinding equipment.
- Where no heat treating equipment is available, as cast alloys require no heat treatment.
- Without special supervision.
- At a tool cost comparable to high-speed steel tools.

#### Carbides

Carbide cutting tool materials are principally a mixture of powdered tungsten carbide in a matrix of cobalt. The cutting properties of carbides are due to the fact that tungsten carbide is second only to the diamond in hardness, and this property remains in a finished carbide tool material. Various grades range from Rockwell-A 89.5 to 94.0.

No method for melting or refining tungsten carbide is known to exist, so tool tips are produced by the powder metallurgy process. The tungsten carbide is easily formed by placing tungsten and carbon in an electric furnace. At furnace temperatures the tungsten combines with the carbon to form tungsten carbide. This material is placed in a ball mill, reduced to a powder, then combined with

about 10 percent of similarly powdered cobalt and placed in a mold under the ram of a hydraulic press. After this compacting operation, the material is firm enough to be easily handled, and is very easily cut, for at this stage the material handles about like chalk. The material assumes its final form after being sintered in a hydrogen atmosphere furnace at a temperature of 2800 deg F.

Evaluating carbides by the factors essential in a tool material:

**Red Hardness** is superior to any other known material except the diamond. The actual temperatures are unknown, but carbide's resistance to cutting temperatures is known to be over 2200 deg F. This increase in red hardness permits the use of cutting speeds with carbides from two to ten times those common with high-speed steel. However, in general, carbides will not withstand the feeds possible with cast alloys or high-speed steels, a reduction of from 30 to 50 percent being common.

**Hardenability:** None.

**Hardness:** The hardest known engineering material.

**Strength:** The compressive strength of carbide is superior to any other known material. Unfortunately, the shear strength is very low; it is good practice in designing carbide tools to consider this factor as nil. The strength required to resist the cutting forces when using a carbide tool must be supplied by a carbon tool shank. This accounts for the almost universal use of carbides in the form of tipped tools. One exception is small (usually 1/4 in. square or less) solid precision boring tools, but these in turn are always supported in a boring bar. Carbide is extremely stiff (the modulus of elasticity is from three to ten times that of steel) in the range of force it is capable of resisting before breaking. This property has led to the use of solid carbide boring bars for finishing small precision bores. As a rule of thumb, in boring small holes it will be difficult to bore a hole whose depth is greater than four times the size of the largest boring bar it is possible to use. When the limit is exceeded, chatter is almost sure to be a difficulty. However, a solid carbide boring bar permits the precision boring of holes to a depth eight times the size of the largest boring bar possible. Unfortunately, the cost is high.

**Ease of Fabrication:** In the pre-sintered stage, it is simple to form carbide (although the shrinkage of approximately 12 percent is a problem), but in the sintered form only grinding is possible. And grinding is possible only with silicon carbide or diamond wheels. It is not weldable, forgeable or machinable, but can be brazed to carbon steels by copper or silver brazing.

**Design Restrictions:** Of primary importance

Westinghouse Electric Corporation, U.S.A.

CARBIDE GRADES AND APPLICATIONS, SINGLE POINT TOOLS ETC.

M-5877

KIND OF CUT ETC.	WESTINGHOUSE GRADE MARKING	SUPPLIER'S GRADES											(NOTE: FIRM NUMBERS, FOR IDENTIFICATION ONLY, DO NOT INDICATE AN ORDER OF PREFERENCE. SEE F-6950.)		
		FIRM NR 6	FIRM NR 9	FIRM NR 2	FIRM NR 1	FIRM NR 5	FIRM NR 3	FIRM NR 7	FIRM NR 8	FIRM NR 4	FIRM NR 10	FIRM NR 11			
CAST IRON, NONFERROUS MATERIALS AND STAINLESS IRONS & STEELS WITH MORE THAN 17% CR															
CONTINUOUS CUT	(W) A	A	CA4	BB3	HAX	MF	K6	C-91	A1	2A5	G1	E6			
INTERRUPTED CUT	(W) B	B	CA10	55A	HC	CR	K25	C-89	B	2A3	G5	E8			
STEEL															
CONTINUOUS CUT, GENERAL PURPOSE	(W) K	C	CA1	78B	TA	CR	K25	S90	C	EM	WM	710			
HEAVY CONTINUOUS CUT	(W) H	D	CA5	78C	T83	CR	KM	S88	C-HD	EE	WM	710			
INTERRUPTED CUT	(W) E	D	CA5	78C	T-04	CR	KM	S88	C-HD	EE	WS	710			
CONTINUOUS LIGHT FINISHING CUTS	(W) F	C	CA2	78	T16	SF	K3H	S92	CF	E	WH	606			
PRECISION BORING	(W) D	CC	CA6	B31	T31	SS	K4H	S92	CF	EH	WH	509			
INSULATING MATERIALS															
MACHINING MICARTA, UNFIRED PORCELAIN	(W) C	AA	CA8	999	HF		K6	C93	469	2A9	GF	E5			
PRECISION BORING-MICARTA, PAPER ETC	(W) W	AA	CA7	905	HE		K6	C91	469	2A7	GA	E5			
FOR MAXIMUM WEAR RESISTING APPLICATIONS															
CENTERS, GAGES, RESTS, GUIDES ETC.	(W) M		CA3	44A	H		KWH			2A3		E12			

\* EXCEPT MATERIALS NOTED FOR GRADES (W) & (M)  
 \* SEE (H) GRADE ABOVE, FOR GRADES FOR MILLING SEE SHEET R-6951-C.  
 (W) WESTINGHOUSE GRADE AND FIRM NR MUST BE STAMPED ON ALL TOOLS  
 (H) WESTINGHOUSE GRADE MARKING 1/8 DIA.  
 (M) MARKING AT LEFT REPRESENTS WESTINGHOUSE GRADE "M" WITH 883 TIP OF FIRM 2.  
 A ALSO REAMER BLANK GRADES.  
 NOTE: SEE STANDARDS SHEET R-6951 FOR TIPS CARRIED IN BOX STOREROOM, E. PSH.

1-52-48

Made in Westchester, N.Y. U.S.A.  
 F-6951

Fig. 2. Works Standards Sheet shows Westinghouse grade recommendations for manufacture.

in any carbide tool design is the fact that the carbide must be adequately supported. For single-point tools, a good rule is that the steel shank under the carbide should have a depth at least three times the thickness of the carbide. If it is not possible to adequately support a carbide cutting tip, it is usually impractical to use carbides.

Intricate forms must be avoided as these usually cause trouble from three sources:

(1) Cracking in the brazing operation due to the widely different coefficients of expansion of carbon steel and carbide.

(2) Considerable difficulty is experienced in grinding. If a carbide is rigidly held in a vise it can be safely ground only with a diamond wheel, and with intricate forms this is prohibitive in cost.

(3) Breakage is a usual source of difficulty in intricate carbide tools, as these are so prone to chatter. And with carbides, chatter is almost always fatal to the tool.

The above remarks suggest that all carbide tool designs be made so as to minimize grinding. If it is desired to eliminate cracking due to thermal expansion, all tips with a straight cutting edge over 3/4 in. wide or a formed cutting edge over 1/2 in. wide should be made and brazed in segments so that no one piece of carbide exceeds these limits.

In designing carbides, all clearance angles must be held to a minimum. Standard Westinghouse

practice is to hold both side and end relief to 6 deg. End clearance angles are maintained at 8 deg whenever possible, but never more than 8 deg in excess of the angle required for zero clearance.

**Carbide grades:** One of the most troublesome features of carbide tools is the fact that the grade of carbide used must suit the application. Fundamentally, there are two types of carbide cutting tools. The so-called "straight" or "cast iron" grades of carbide consist only of "WC" and the cobalt binder. This grade will cut cast iron and any material except steel. Steel cannot be successfully cut with this grade as the temperature of a chip tends to weld it to the carbide during cutting and this action soon ruins the tool. For cutting steel, the so-called "steel" or "mixed" grade of carbide is required. This type of carbide has, in addition to the "WC", from 10 to 40 percent of titanium and tantalum carbides, as well as a greater percentage of cobalt binder. To illustrate these compositions, the most popular "cast iron" cutting grade of carbide used by Westinghouse has the following approximate analysis: 94.25 percent WC, and 5.75 percent CO.

The most popular general purpose "steel" cutting grade has the following analysis: 82 percent WC, 8 percent CO, 10 percent TIC.

Since varying the percentage of the carbides and binders alters the relative values of hardness and resistance to abrasion and shock in the finished tool, various grades are offered to suit the type of cut being taken. If a high-speed finish cut is attempted, using one of the softer grades of carbide designed for heavy interrupted cut service, the abrasive action of the high-speed will wear away the carbide and the work will lose size rapidly. If a heavy interrupted cut is attempted using a finishing grade of carbide, the tip will shatter on the first heavy impact. Table I shows the general relationship between various steel cutting grades.

Because it is the major factor controlling the maximum cutting speed of a tool material, red hardness is the most important characteristic of a cutting tool material. As the red hardness increases, the permissible maximum cutting speed increases.

**Table II—Comparison of Unit Cutting Times for Various Tool Materials**

Tool Material	Unit Cutting Time, Min.
Carbide (Best Grade Selection)*	1
Carbide (Average Grade Selection)*	1.96
Carbide (Good Grade Selection)*	1.36
Cast Alloy (Best Materials)	2.14
H.S.S. (Best Materials)	5.10

The above values are based on laboratory performance with rigidly supported work and tools. All values are for cutting dry with single point tools used in a lathe. No shock or interrupted cuts were present.

\*All carbide values are based on the best comparable grade of all manufacturers.

It would appear that the cutting speed for instantaneous tool failure would be a suitable value to use as the maximum cutting speed possible for any tool material. But in an extensive series of tests made at the Headquarters Manufacturing Laboratory of Westinghouse, it was found that the correlation between cutting tool temperature, the cutting speed at instantaneous failure, and the rating of the same materials tested in the range of normal cutting speeds was poor. It has been found that the best method of comparing one tool material with another is to compare their speed-tool-life curves. Obviously this method involves a consideration of many other properties than red hardness, but such curves are an accurate reflection of how the tool materials will compare under average shop conditions.

### Cutting Speed Varies Tool Life

Each of these curves shows how tool life measured in cubic inches of metal removed will vary as the cutting speed is varied. By comparing one curve with another it is possible to get an accurate comparison of the tool materials. In comparing the curves of Fig. 1, note that a feed of 0.030 in. is used for high-speed steel and cast alloy tools, but that a feed of 0.015 in. is used for the carbide curves. This is because this reflects the standard test conditions used by Westinghouse for evaluating cutting tool materials. A more accurate comparison can be made if these curves are compared on the basis of cubic inches of metal removed per minute, or comparative unit cutting times. Table 2 shows the comparative cutting times for each of the curves of Fig. 1.

The three carbide curves in Fig. 1 are of particular importance because they illustrate the effect of grade selection. For an application under the test conditions under which this curve was developed, the usual Westinghouse grade recommendation would be the WN Grade. An examination of Works Standards Sheet 6951 (Fig. 2) will show that the usual Westinghouse grade is about one grade softer than that commonly made by the carbide manufacturers. This is because experience has indicated that the extra costs of tool breakage, supervision, etc., of the harder grade more than offsets the advantage of the harder grade. The carbide curves of Fig. 1 illustrate the savings in cutting time possible by utilizing the hardest grade of carbide that the conditions of the operation permit. If a moderate shock had been prevalent when the tests for these curves were made, the WD grade would certainly have failed instantly, and the WK grade would probably have failed. If the shock had been heavy, the WN grade might have failed, and so a softer grade, or even a softer grade used with a negative rake design, might have been required to have withstood the conditions of the cut.

# Brittle Coatings for Stress Analysis

By Greer Ellis

CONSULTING ENGINEER  
MAGNAFLUX CORPORATION

## Part II

The range of strains at which the coatings can be made to just start cracking is 0.0005 to 0.003 in. under normal operating conditions. The coatings can be further sensitized down to 0.0001 in. strain by cooling them while static load is applied. The quantitative accuracy under the best of conditions is within plus or minus 5 to 10 percent, which is ample for most engineering problems. Under less favorable conditions of operation, such as out in an open shop, the quantitative accuracy is of the order of plus or minus 10 to 25 percent.

The coatings not only respond to static loads but they respond very well to dynamic loads. It is easy to produce strain patterns under the highest rates of loading that can be applied to a structure, such as when a bullet strikes. Results under such dynamic loading conditions can be readily correlated with static tests on the same structure.

The usual system of making static tests is to use a single coating and observe the start and spreading of patterns as the loads are increased. Controlled

and measured loads are required. This was the system used in the three examples described earlier.

Sometimes, particularly under dynamic loading, it is difficult to control and measure the load. Then the scheme to use several different coatings which will start to form patterns at different threshold levels of strain. The different coatings are either applied on the same part at different times, or on different parts. Or if the part is symmetrical as in the case of the fan blades shown in Fig. 4 different coatings can be applied to symmetrical sections. Loading is always the same one amount, and calibration strips are run for each coating. Results will come out as shown in Fig. 4, where the boundaries of patterns for four different threshold values give a good picture of stress amount and distribution.

Another job that brittle coatings can do is to measure the locked-up residual stress in a material. The system is to drill small holes such as an  $\frac{1}{8}$  in. in diameter  $\frac{1}{8}$  in. deep through the coating and into the material below, and then immediately sensitize the coating. Radiating star patterns indicate

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

Fig. 4. Four fan blades covered with coatings of different threshold sensitivity show areas of stress amount and distribution.

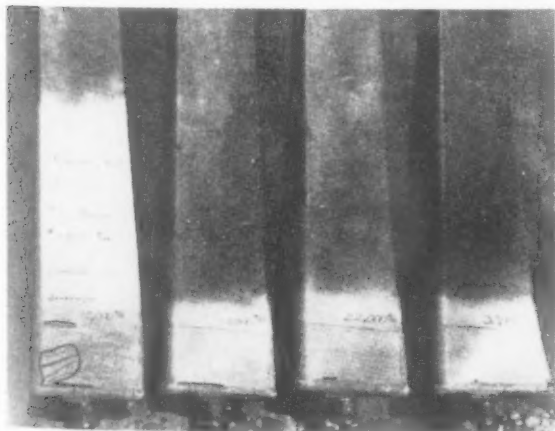
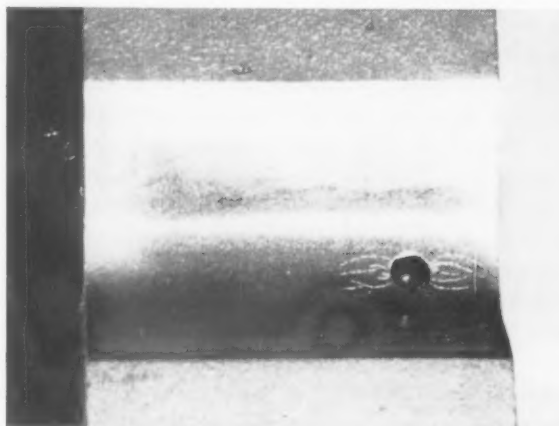
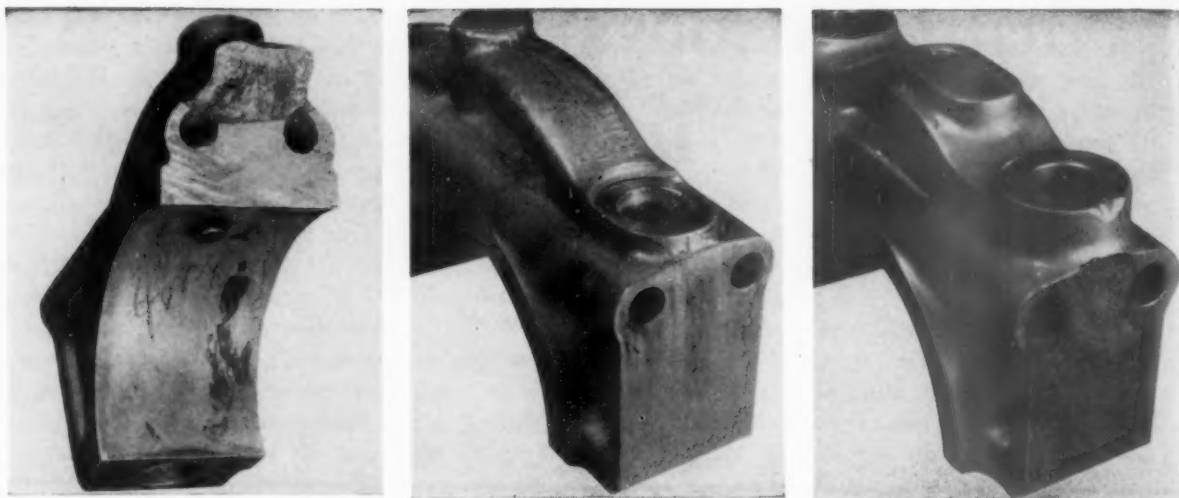


Fig. 5. Tension residual stress pattern shows up on fillet at hole drilled through coating. (Compression would show as circles.)





Pictures tell of problem concerning connecting rod cap. Fig. 7, center, shows original design. Static tests with Stresscoat showed that the operating stress and the bolting-up stress added together in same fillet of the spot face. Fig. 6, left, pictures service failure of the cap. Origin is in fillet of spot facing. Right, Fig. 8 pictures solution of trouble. Leaving raised boss eliminated the locking-up of tension stress in the fillet when bolting-up. Operating stress remains about the same but alone causes no trouble. (Courtesy Continental Aviation and Engineering Corp.)

residual tension; circles indicate residual compression. The residual strain is roughly 0.0007 in. for each diameter of hole that the patterns extend out beyond the edge of the hole.

This system of residual stress measurement came in very handy at a time when several manufacturers of diesel engines were adding localized heat treatment on the throws of their crankshafts to reduce wear in service, and promptly started to have epidemics of fatigue failures in the fillets at the end of the throws. Some brittle coat tests, involving the drilling of holes in the fillets, showed the cause to be an excessive amount of residual tension stress locked-up in the fillet (Fig. 5) by the localized heat treatment out on the throw. The residual stress by itself would not have caused trouble but it added to the working stresses and the combination was too much. Eliminating the residual tension stress eliminated service failures.

#### Failure by Lock-Up Stress from Bolting

Another kind of locked-up stress occurs during assembly of parts. Sometimes bolting-up stresses are great enough to cause failure immediately as plastic part assemblers are well aware. On metals the danger may be real but not so apparent. An excellent case in point is the connecting rod cap story told in Figs. 6 through 8. The original design shown in Fig. 7 had a cut-down boss which failed as shown in Fig. 6. A heavily beefed-up cap was promptly made and promptly failed. At this point experimental stress analysis came in. A brittle coating test with static tension load on the connecting rod and cap showed that working stresses were moderately high in the fillet of the spot facing. Then a separate coating test consisting merely of bolting up

the cap on the rod showed that tension stress of fairly large amount was locked up in the same fillet. Together the two stresses spelled trouble. How to cure? The answer was, not to machine off the boss but to leave it high enough (Fig. 8) so that the bolting-up stress in the fillet is not only dissipated but may actually go into compression, which is a further protection against fatigue failure.

Occasionally trouble arises, not from fatigue failure, but from the fact that the part takes a permanent set when bolted up or operated, and it is difficult to locate the areas which are doing the yielding. Brittle coating stress analysis can help here by showing up local yielding by a flaking-off of the coating from the surface. Fig. 9 shows how localized yielding in soft steel can spread a long ways around a section before it becomes apparent to usual ways of observing permanent set.

Fig. 9. Localized yielding shown by flaking-off of coating.



# JIC Pneumatic Standards for Industrial Equipment (Continued)

**A1.1.5** Requested number of copies of final diagrams and texts shall be forwarded by mail or in person to an individual delegated by the purchaser not later than the date on which the shipment is made.

## A1.3 Standard Symbols

### Introduction

(a) Standard symbols shall be used for symbolic diagrams and for showing flow paths in schematic diagrams.

(b) Directional Control Valves: The flow condition

which is shown closest to the operating device is that which exists when the device is operated.

(c) The Standard Symbols and sample drawing of a Pneumatic Circuit utilizing the Standard Symbols to indicate the nature and function of component parts in the circuit shall be in accordance with the following recommendations: (basic symbols can be combined in any form desired. No attempt is made to show all combinations.)

LINES	
LINE, WORKING	
LINE, PILOT	
EXHAUST	
LINE, FLEXIBLE	
CONNECTOR (DOT TO BE 3 = WIDTH OF ASSOCIATED LINE)	
DIRECTION OF FLOW	
LINE, PASSING	
LINE, JOINING (TEE CROSS ETC) (DOT TO BE 3 = W)	
STORAGE OR SURGE TANK	
PLUG OR PLUGGED CONNECTION	
TESTING STATION (GAGE CONNECTION)	
POWER TAKE-OFF	
RESTRICTION, FIXED	

COMPRESSORS	
COMPRESSOR, SINGLE FIXED DISPLACEMENT	
COMPRESSOR, SINGLE VARIABLE DISPLACEMENT	

MOTORS AND CYLINDERS	
MOTOR, ROTARY FIXED DISPLACEMENT	

MOTORS AND CYLINDERS-CONT'D	
MOTOR, ROTARY VARIABLE DISPLACEMENT	
MOTOR, OSCILLATING	
CYLINDER, SINGLE ACTING PLUNGER TYPE	
PISTON TYPE	
CYLINDER, DOUBLE ACTING SINGLE END ROD	
DOUBLE END ROD	
CYLINDER, ROTATING, AIR	

MISCELLANEOUS UNITS	
MOTOR, DRIVE, ELECTRIC	
LUBRICATOR	
INTENSIFIER	
ACCUMULATOR	
FILTER	
SEPARATOR	
PRESSURE SWITCH	
PRESSURE GAGE	
SPRING	
SHAFT, ROTATING	
COMPONENT ENCLOSURE	

## JIC Pneumatic Standards for Industrial Equipment (Continued)

VALVE		METHODS OF OPERATION-CONT'D	
VALVE, CHECK		CONTROL, CENTRIFUGAL	
VALVE, RESTRICTION, VARIABLE		CONTROL, COMPENSATOR	
VALVE, BASIC SYMBOL (INSERT MODEL NO. FOR SPECIAL VALVES)		CONTROL, COMPENSATOR PRESSURE	
METHOD OF INDICATING INTERNAL FLOW		CONTROL, COMPENSATOR TEMPERATURE	
VALVE EXAMPLES		CONTROL, CYLINDER	
VALVE, MANUAL SHUT OFF		CONTROL, DETENT	
VALVE, MAXIMUM PRESSURE		CONTROL, MANUAL	
VALVE, RELIEF REMOTELY OPERATED		CONTROL, MECHANICAL	
VALVE, SEQUENCE DIRECTLY OPERATED		CONTROL, MOTOR ELECTRIC	
VALVE, PRESSURE REGULATOR		CONTROL, MOTOR AIR	
VALVE, FLOW CONTROL PRESSURE COMPENSATED		CONTROL, PILOT HYDRAULIC	
		CONTROL, PILOT AIR	
VALVE, SHUT OFF 2 POSITION-2 CONNECTION		CONTROL, SERVO	
VALVE, DIRECTIONAL 2 POSITION-3 CONNECTION		CONTROL, SOLENOID	
VALVE, DIRECTIONAL 2 POSITION-4 CONNECTION		CONTROL, SOLENOID HYD. PILOT OPERATED	
VALVE, DIRECTIONAL 3 POSITION-4 CONNECTION CLOSED CENTER		CONTROL, SOLENOID AIR PILOT OPERATED	
† METHODS OF OPERATION		CONTROL, THERMAL	
CONTROL, BASIC SYMBOL		CONTROL, PILOT HYD. DIFFERENTIAL AREA	

† REFER TO SENTENCE (B) OF PARAGRAPH A13

## The Elements of Broaching-- Procedures, Tools and Applications

Andrew E. Rylander

**B**ROACHING IS ONE of the fastest methods for precision duplication in metal processing and, ordinarily, requires but a single tool and one pass to complete an operation. The exceptions would be those jobs where excessive stock removal, secondary operations or indexing—as for gears—would entail two or more passes. Even here the succeeding passes may be repetitions of the first and may usually be done at the same setting of the workpiece.

Because the skill is built into the tool, about all that is required of an operator is loading and unloading the work and removing and reinserting the broach after each pass. Even these functions may be eliminated

with automation. For most applications, the one broach serves as both rougher and finisher and, barring careless handling or grinding, will duplicate its designed profile *ad infinitum* until the teeth are worn or ground below original limits of tolerance.

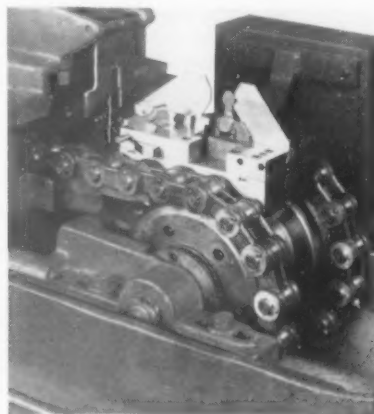
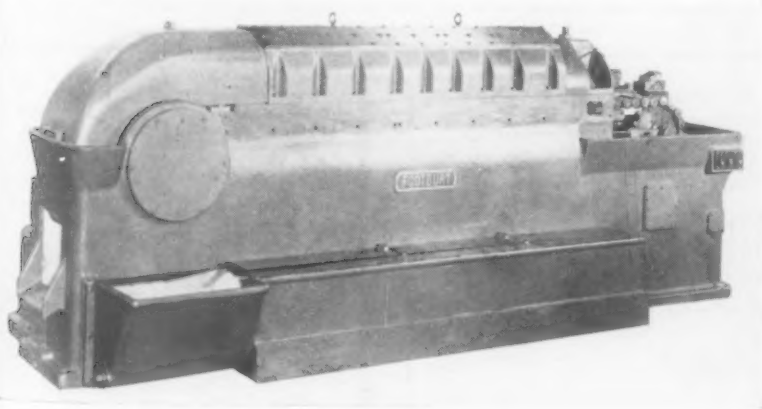
As may be inferred from the foregoing the broaching process itself is rather simple as compared to certain other methods of metal processing. However, the manufacture of broaching equipment is largely a specialty for specialists of which discussion would serve no useful purpose as far as this report is concerned. Rather, we will deal with procedures, tooling and applications, the while present-

ing basic elements of design to the end that the lay reader—as differentiated from the specialist—may have a clearer understanding of essential factors.

These include capital equipment; the materials to be broached; the broaches, of which there is infinite variety; the broach holders; and the fixtures. The latter constitute an important item because, in view of the short interval of the cut, time saved in loading and unloading the workpieces has a marked bearing on cost of manufacture.

Capital equipment—that, is, the machines—range from manually-operated arbor presses through powerful hydraulic machines specially

Fig. 1, showing a chain-drive, continuous-type broaching machine. The detail at right is a view of the loading end. The workpieces, loaded on fixtures attached to the chains, pass through stationary broaches and are automatically discharged at the rear of the machine. The part shown in the fixture is broached on both sides in one pass.



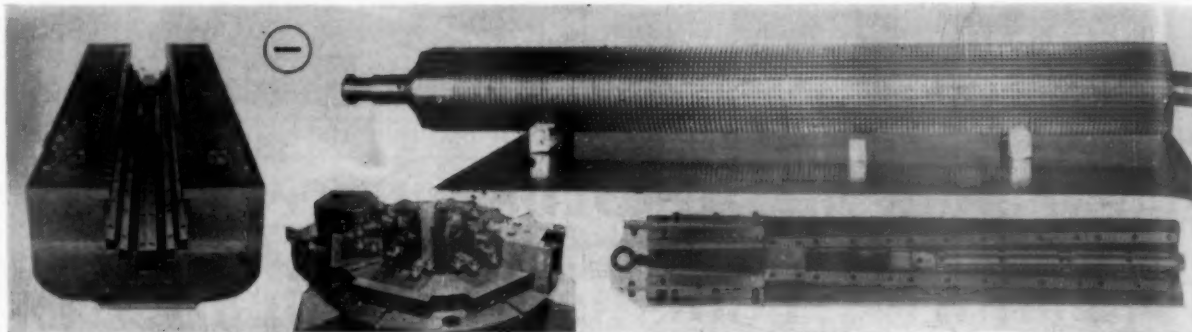


Fig. 2, showing assorted broaches. At left, a tunnel-type broach with holder; at lower center, a stationary broach for vertical operation; and at top, a pull broach designed to cut a 44-tooth involute spline in one pass. This "giant" is 9-3/16 in. O.D. and over 7 ft. long; the others in proportion. Size range can be judged from the encircled line, which represents a midget broach.

engineered for broaching. In this connection, modern broaching machines are preponderantly hydraulic, a notable exception being a chain-driven machine—shown in Fig. 1—which is designed for continuous operation. Fixtures, attached to the chains, carry the parts through stationary broaches and automatically discharge them at the rear of the machine.

Exceptions notwithstanding, broaching did not come into its own as a factor in mass production until the advent of the high speed steel broach and the hydraulic broaching machine, respectively introduced around 1925 and 1928. The latter permitted vertical broaching, while the former raised cutting speeds

from 6 ft. per minute—the practical limit for carbon steel broaches—to 30 fpm. It also provided the strength for heavier cuts and so forced development of more powerful broaching machines. Between them, the two projected broaching into the first division in metal processing.

### Types of Broaches

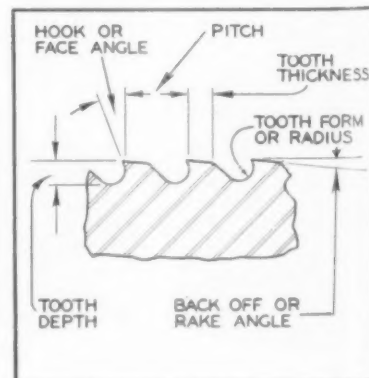
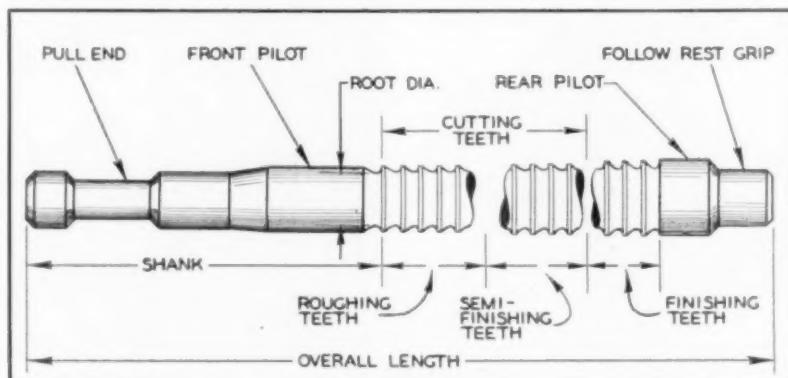
So much for background of the broaching process. We will now discuss the broaches; this, however, slanted to the needs of the user rather than the specialist. Recommendations are to be interpreted as a guide to selection and care of broaches, rather than toward design *per se*,

and are based on the assumption that the user plant has broaching machines of ample power capacity.

The "cutting tools", to use that term, range from tiny push broaches to intricately shaped solid and sectional broaches weighing a half ton or more. They are classified by methods of operation, as push and pull; by type of operation, as internal and external; as solid, built-up, inserted-tooth, and progressive; by function, as keyway, round hole, serration, spline, spiral spline, rifling, surface and burnishing; and so on through the list. A typical assortment is shown in Fig. 2.

The basic requirements of a broach are adequate strength and chip-carrying capacity. Without the

Fig. 3, left, shows a typical internal broach, and Fig. 4, right, the tooth form of a broach. Approximate face angle values for broaching various metals are as follows: for cast iron, 6 to 8 deg; hard steel, 8 to 12 deg; soft steel, 15 to 20 deg; aluminum, 10 deg plus; and brittle brass, negative 5 to plus 5 deg. Essential requirements are ample strength and chip-carrying capacity,



## Tool Engineering Report

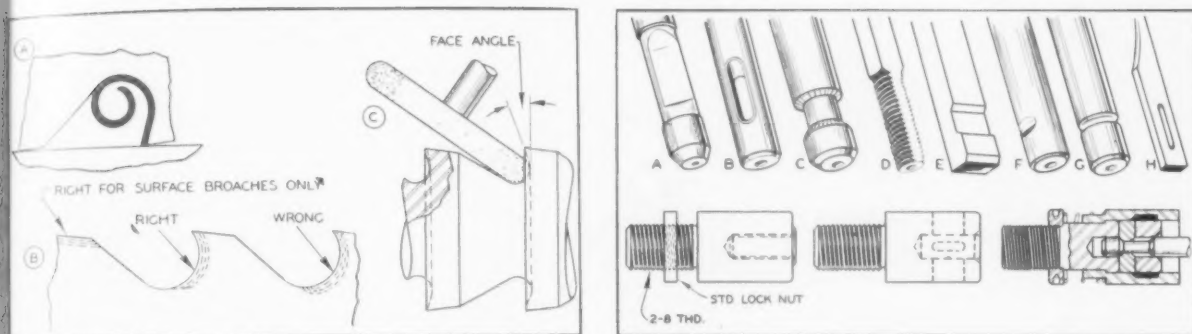


Fig. 5, shows, at left, a typical chip curl—A—from a broach having proper tooth form. B shows correct and incorrect methods of sharpening. Sketch C shows a proper grinding setup.

Fig. 6, right, shows—at top—eight typical broach shanks or pull ends. At lower left, a threaded pull-type head such as used with shank D; at center, a head for use with shank B; and at right, a cross-section of a 4-jaw automatic coupling head such as used for shank C.

one, the broach will break or buckle, depending on whether it is pull or push type. Lacking the other, chips will pack in the tooth spaces and, in addition to impairing surface finish, may damage individual teeth or cause failure of the entire broach.

The strength of a broach is determined by its minimum cross sectional area, usually occurring at the root of the first tooth or at the area surrounding the slot end. See Figs. 3, 4 and 5 for elements of broach design, and Fig. 6 for standard broach shanks and holders. Among other methods, the strength of a pull broach may be calculated as follows:

$$0.7854 D_r^2 = \text{area at root dia.}$$

$$0.7854 D_p^2 = \text{area thru pull slot.}$$

$$A \times 200,000 / S = \text{allowable pull, psi.}$$

In which  $D_r$  = minimum root dia.;  $D_p$ , dia. of pull end;  $W$ , width of pull slot;  $S$ , factor of safety; and  $A$ , area of minimum section.

Calculation for strength of a push broach is based on the assumption that when  $L / D_r$  is greater than or equals 25, the broach may be considered as a long column that will buckle and snap when overloaded. Strength may be computed by the following formula:

$$13,500,000 \times D_r^4 / SL^2 = \text{allowable load, psi.}$$

In which  $L$  = length from push end to the first tooth;  $D_r$ , the root dia at  $1/2 L$ ; and  $S$ , the factor of safety.

Pitch, which determines construction and strength of the tooth, and the allowable chip space, is an im-

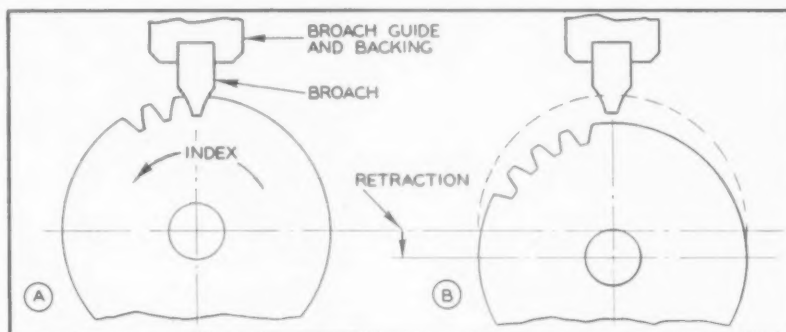
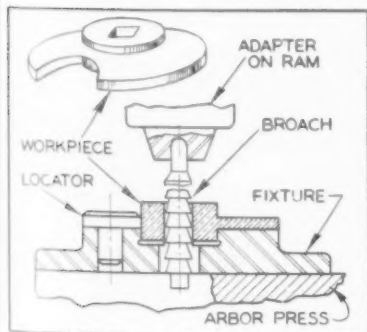
portant factor in broach design. As it is a function of the length of cut and chip thickness, it will vary somewhat with the material being broached; for example, the allowable pitch for cast iron would be less than for steel because less chip space is required. See the caption, Fig. 3.

In any event, the pitch should permit at least two teeth and preferably more to be engaged in the cut simultaneously, both to keep the workpiece in alignment and to reduce shock as following teeth come into engagement. Pitch may be determined as follows:

$$\text{Pitch} = 0.34 \sqrt{\text{length of cut}}$$

While surface broaches compare in general design with internal broaches, strength becomes a subordinate

Fig. 7, at right, shows a simple setup for broaching a bronze part. The broach used was made of C.R.S., cyanide hardened. Fig. 8, at right, a schematic diagram showing a method for broaching external gears. Usually, several teeth are broached per pass, the fixture retracting for index on the return stroke. Broaching is continuous until all teeth are cut.



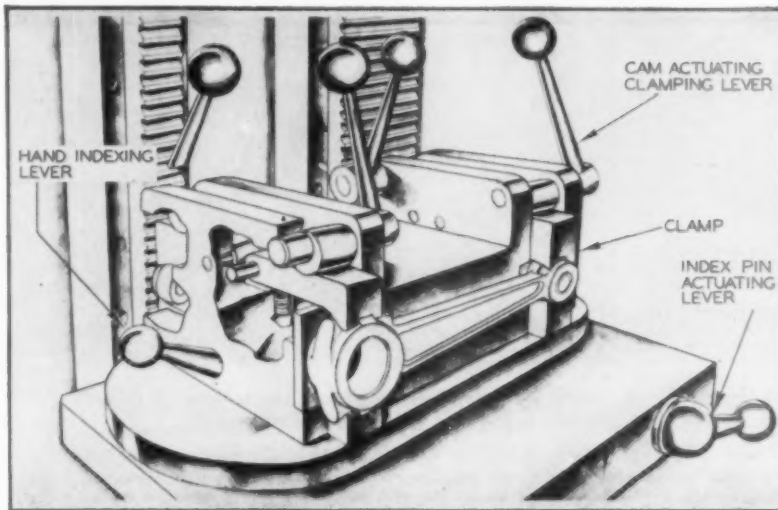


Fig. 9, an index holding fixture for broaching thrust faces on connecting rods. The operator unloads and loads one station while the opposite is in broaching position.

factor since one is less restricted by space limitations. This permits more "meat" in the tool. One may further take advantage of shear cutting—not ordinarily practical with internal broaches—which, reducing vibration, results in a superior surface finish. Shear angles vary from 5 to 20 deg, even more for special applications. However, shear cut is not ordinarily applied to surface broaching of slots because the shear tends to crowd chips to one side, producing a rough surface.

### Broach Materials

While the materials commonly used for internal broaches are 18-4-1, 18-4-2, and Moly high speed steel—which, as previously stated, permit cutting speeds of 30 fpm—surface broaches for certain materials may incorporate tungsten carbide inserts. While these portend surface speeds comparable to other metal cutting applications, the high extremes are not ordinarily used in broaching.

As in most things, there are exceptions to rules. For example, Fig. 7 shows a setup for broaching  $\frac{1}{4}$  in. square holes in bronze discs. For this job, broaches made from  $\frac{1}{4}$  in. keystone served nicely for roughing.

Fig. 10, a fixture for broaching locating points on connecting rods. The application is similar to that shown in Fig. 9.

the finish—or sizing—cut being taken with a carbon steel broach. Naturally, mild steel broaches are not recommended for production runs.

The foregoing covers the high points of design. Along with that, it may be well to briefly discuss the care of broaches. For while the most economical of cutting tools as far as high production with long life is concerned, broaches are nevertheless expensive as regards first cost. Therefore, they should be carefully handled and as carefully stored to insure against damage.

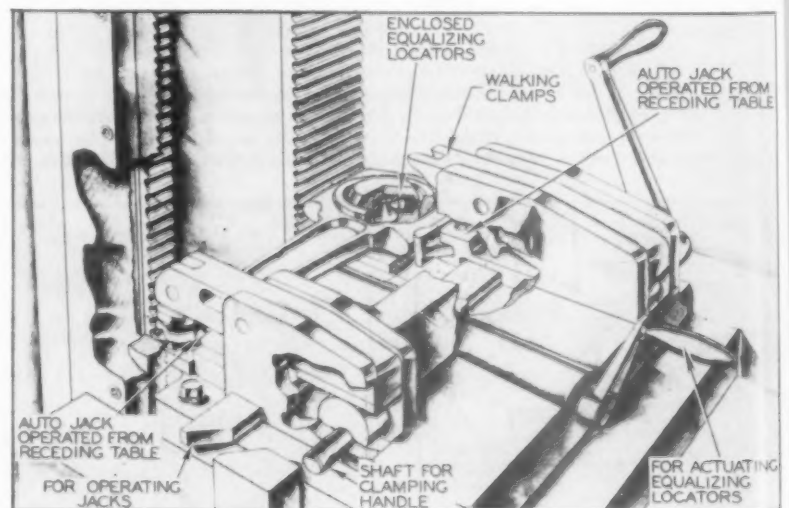
Extreme care should be exercised in regrinding, making sure that the

proper wheel grade and grit is used for a given broach material. Except for surface broaches, which may be ground on the O.D., following the original rake angle, internal broaches may be ground on the faces only. The "right and wrong" of broach grinding is shown in Fig. 5 and further explained in the caption.

### Tools and Applications

Because broaching speed is constant for a given application, and broach ends and pullers standardized for quick change, all saving in time outside of the broaching cut and removal and reinserting of the broaches must be effected by the fixtures—that is, by the speed at which the work may be positioned, presented to the cut, and unloaded. And since the application largely determines the type of fixture, the two will be discussed jointly.

In view of broadening applications as industry imposes new demands on the makers of broaching equipment, it may be of interest that broaching operations incidental to manufacture of an 8-cylinder automotive engine totals less than 100, and—citing re-



## Tool Engineering Report

Fig. 11, a hydraulic fixture for broaching the half-round and flats on bearing caps. Clamping is automatic. The built-up broach, containing five broaches in the one holder, is similar to one of the broaches shown in Fig. 2.

lated units—for a 28-cylinder reciprocating aircraft engine less than 200 operations. By comparison, a mean average of some 15,000 broaching operations for jet and turbine aircraft engines assumes astronomical proportions!

To a considerable extent, broaching has superseded conventional milling and gear cutting practises—with, it may be added, advantages in cost and, in some instances, in quality. For example, the large pull broach shown in Fig. 2 produces a 44-tooth  $9\frac{3}{16}$  in. diameter involute spline for rear axle ring gears in one pass, as compared to 44 passes with conventional gear cutting. On the opposite extreme may be cited broaching of involute splines as small 5-tooth  $\times \frac{1}{8}$  in. diameter.

While splines and internal gears may be broached complete in one pass, external gears may be cut one space per pass—as indicated by Fig. 8—although usual practise is to cut several teeth per pass. The fixture retracts and indexes on the return stroke, the broaching cycle being

continuous. Loading and unloading of the work may also be completely automatic.

### Advanced Tooling

Because broaching has made its major impact in the automotive and aircraft industries, and also in production of armament, we turn to these fields for timely applications and tooling. Here, the fixtures shown in Figs. 9 through 12 may be considered typical of advanced design and are of especial interest since the cut-aways show construction details. All four broaching operations are performed on ram-type machines, cut-

ting stroke downward.

Figs. 9, 10 and 11 show, in turn, simultaneous broaching of several faces on connecting rods and bearing caps. The first is an index fixture which permits loading one side while the other is in the cut. Clamping and index is manual. The second is a shuttle fixture in which clamping is semi-automatic, auxiliary jacks being actuated by the recession and advance of the table. The third is a hydraulic fixture designed for automatic shuttling and clamping.

That magazine feeding and automation play important roles in broaching is indicated by Figs. 12 and 13 in which, respectively, flats on king pins and slots on piston pins are broached on automatic cycle. The parts are hopper fed, automatically positioned in the interval between cutting strokes, then automatically discharged on the return stroke.

An interesting example of tooling is shown in Fig. 14, in which parallel bores in track links having slightly variable center distances are broached simultaneously. The broach holder and fixture are designed so that one side of the holder and one

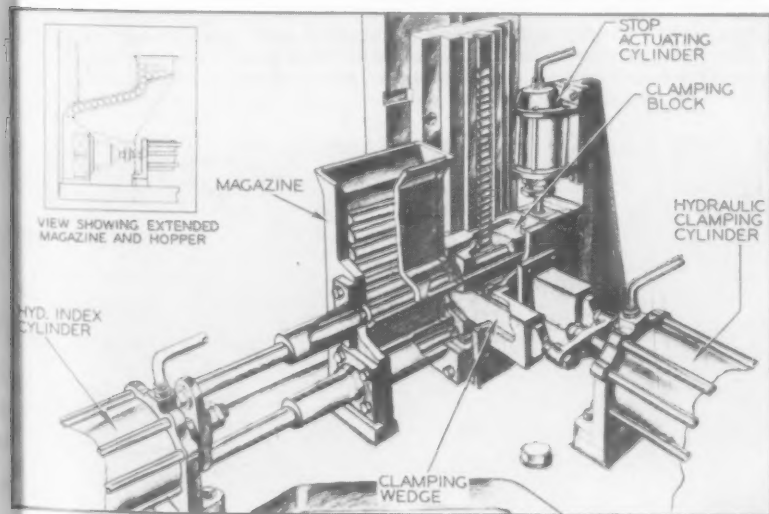
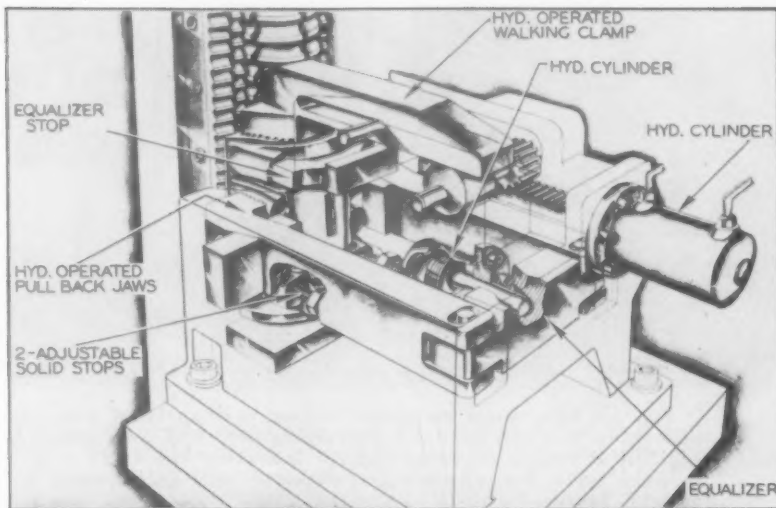


Fig. 12, an automatic shuttle-type fixture for broaching flats on king pins. Magazine-loaded parts are automatically positioned and discharged during the broaching cycle. All drawings, Figs. 9 to 12, are cut away to show construction details.

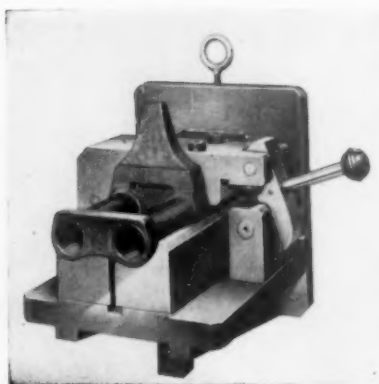
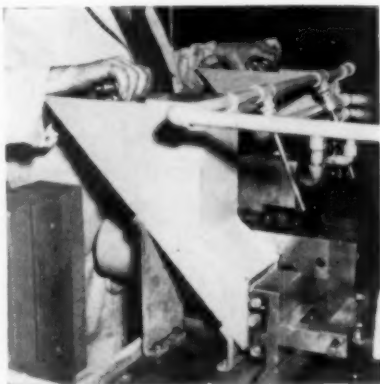


Fig. 13, left, shows magazine feeding in connection with slotting piston pins. Broaching is push-down and continuous, a part being broached and discharged with each broaching cycle. Fig. 14, at center, shows tooling for broaching two 1.375 in. holes at semi-flexed center distance in track links. Fig. 15, at right, shows a "trial horse" setup for broaching rotors. See Figs. 16 and 17, below.

V-block in the fixture float to compensate for center-to-center variations.

### Preliminary Tooling

The more involved applications, such as broaching of "christmas-tree" or other odd-shaped slots in gas turbine rotors, may call for considerable experimentation along with preliminary tooling. Such a "trial horse" is shown in Fig. 15—the prototype of the massive, self-contained floor-type broaching fixture shown in Figs. 16 and 17. The latter illustrations show a suggested slot form.

The parts must be held to close surface finish and dimensional tol-

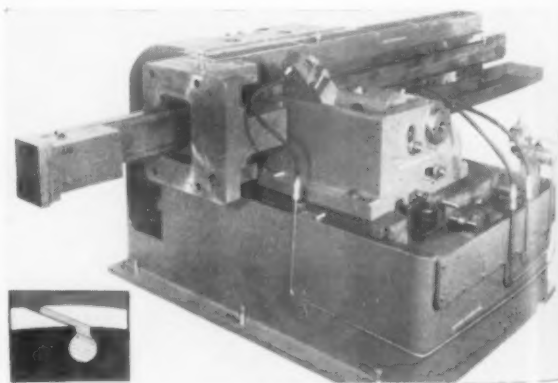
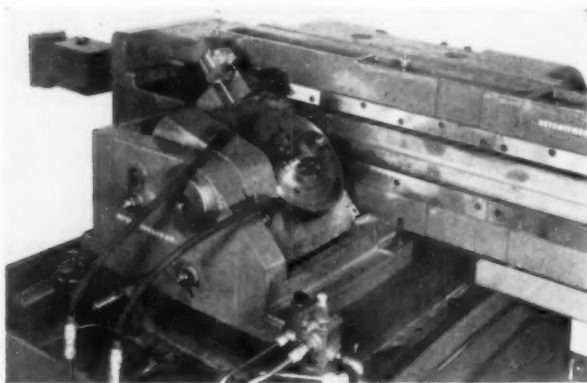
erances—as, for example,  $\pm 0.002$  in. for depth of slot;  $\pm 0^\circ 5'$  for angularity; with slot spacing  $\pm 0.001$  in., non-accumulative. Close enough, considering the number of slots in a wheel! For the purpose of its work, this fixture is practically universal in that it takes wheels in any diameter range from 6 to 24 in., indexes from zero to infinite, and is adjustable to machine slots at any angle from 0 to 45 deg.

Massive construction provides the "meat" to reduce vibration and insure a uniformly smooth surface; furthermore, it is completely automatic cycle, power being supplied

by a horizontal broaching machine attached to the main slide. The work holder is mounted on a shuttle table which recedes for index. This is but one of many ingenious fixtures especially engineered for aircraft applications.

A typical application of surface broaching is shown in Fig. 18, where four surfaces on steering knuckle spindles are broached per pass. Identical shuttle fixtures permit one to be loaded while the other advances for broaching; thus, broaching is continuous to all practical purposes. Another interesting application—involving the broaching of the walls of tubes—is shown in Fig. 19 and further explained in the caption.

Figs. 16 and 17, left and right, show a large floor-type fixture for broaching slot forms in rotor wheels for gas turbine compressors. Completely automatic, the fixture takes wheels up to 24 in. diameter. Index range is indefinite. The inset suggests a slot shape.



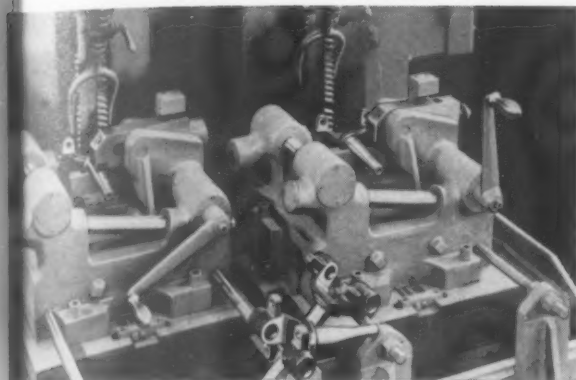


Fig. 18, at left, shows a duplicate tooling for finishing broaching four surfaces per pass on forged steel steering knuckle spindles. One shuttle fixture retracts for loading while the other is in the cut. Output is stated as 410 per hour with broaching speed 30 fpm.



Fig. 19, at right, shows an interesting application of broaching thin-walled tubing. The tubes are positioned on the pull end of the broaches. As the latter are pushed up by elevators and gripped by their holders, they carry the tubes with them against a stop. The broaches then pull through, when the tubes drop down, to be deflected and discharged. The machine ram then lowers the broaches to the elevator grips, when loading is resumed.

## High-Speed Broaching

Having shown applications calling for nominal cutting speeds, we now turn to high-speed surface broaching, such as indicated in Fig. 20. Here, cast iron intake manifolds are broached on two angular faces in one pass, using carbide insert broaches. Broaching speed is 90 fpm, with output stated as 140 per hour. The operator merely positions the part in the fixture, which then automatically applies clamping, swings

into position for broaching and automatically discharges the work at the end of the cutting stroke.

An excellent example of high-speed continuous surface broaching is shown on the front cover, where cast iron cylinder blocks are conveyor fed across stationary broaches at a speed of 60 fpm. In a similar application—not shown—V-type cylinder blocks are broached both faces at one pass, the blocks being fed through tunnel-type broaches at 60 fpm.

## Rifling

In the armament field, broaching has cut time and costs in the rifling of both small arms and large-caliber guns. Shoulder and hand arms are usually pull broached in two passes—one roughing, one finishing—with the twist governed by a master helix. Such broaching is also subject to semi-automation. In the case of large-bore guns, cutter heads mounted on a master helix are successively pushed through until rifling

Fig. 20, an automatic cycle setup for broaching both angular faces of an inlet manifold for V-type engines. The built-in, hydraulically-operated fixture, shown at right, swings out for loading, then swings in and locks with start of the broaching cycle. The operator merely loads and unloads. Broaching speed, using carbide roughing and finishing broaches, is 90 fpm and output is stated at 140 per hour.

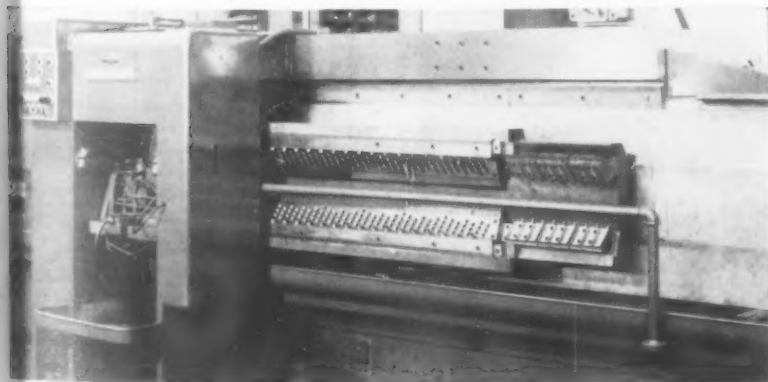


Fig. 21, showing a setup for broach rifling 30 cal. barrels. A set of two broaches—a rougher and a finisher—are required to complete the rifling. Production rate for this ultra-precision job is about 30 barrels per hour.

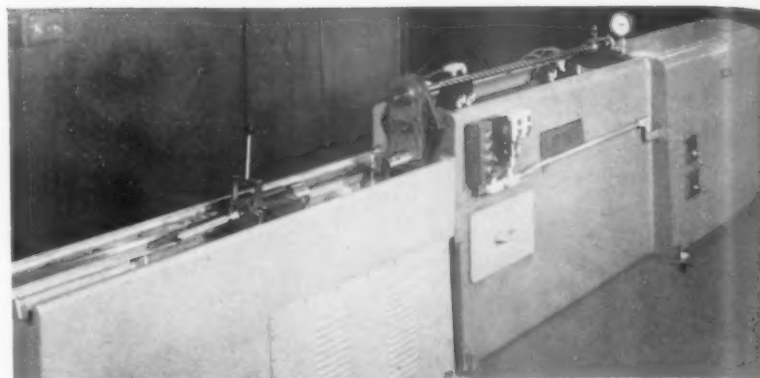
is completed. Examples of small and large bore rifling are shown in Figs. 21 and 22.

## Tooling Can Be Simple

In the foregoing, we have presented highlights of tooling as applied to typical present-day applications. It should not be inferred, however, that tooling need be involved or complex for economical functioning. For example, a simple fixture such as shown in Fig. 7 provides all necessary elements of accuracy with rapid loading. Used with pull broaching on a horizontal machine, it also provides fast unloading since the workpiece can drop off as soon as the broach is pulled through.

The essential requisites in fixture design, since they insure quality, are accuracy and rigidity. Quick loading and unloading are complementary factors since they determine quantity of output; nevertheless, they are subordinate to accuracy. The ideal design combines accuracy and speed of operation with simple functioning.

With regard to time of broaching, one may assume normal cutting speeds as 12 to 24 fpm, with 30 fpm as the high limit for high speed

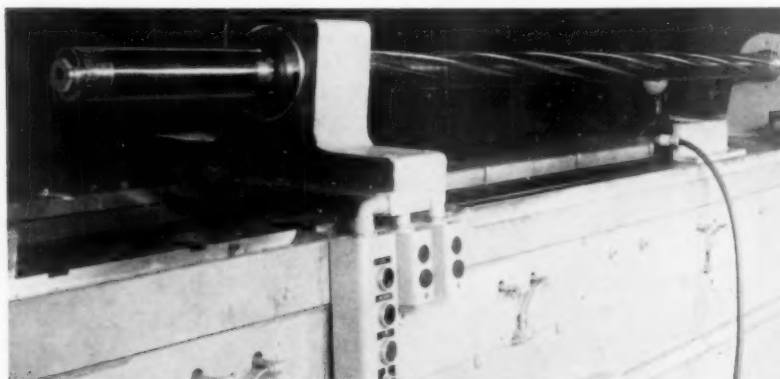


steel broaches. To the time for the power stroke, then—and disregarding the return stroke since loading and unloading may be done in that interval—add the time to remove and reinsert the broach, plus start and stop, and you have the approximate time for the entire broaching cycle.

To cite a typical example, assume a power stroke of 6 ft. at 20 fpm and return stroke at 40 fpm. Then, with cutting stroke 18 seconds, and assuming unloading, loading and exchange of broach in the 9 second interval of the return stroke, one adds time to start and stop—about 2 seconds—to obtain a total of 20 seconds for the cycle. At 85 percent efficiency, that would presume an output of about 153 pieces per hour. Reduced to simple formula, one can determine approximate output as follows:

$3,600 \times \text{efficiency} / \text{cycle time in seconds}$

Fig. 22, showing the cutter head for rifling medium sized gun barrels. Forty cutter heads are required to complete the rifling, each cutter being passed through the bore once.



## Bibliography

"Broaches and Broaching", by the Broaching Tool Institute

The Tool Engineers Handbook

## Credits

American Broach & Machine Company

Apex Broach Company

The Cincinnati Milling Machine Company

Colonial Broach Company

Detroit Broach Company

The Foote-Burt Company

The Lapointe Machine Tool Company

National Broach and Machine Company

The Oilgear Company

## Cover

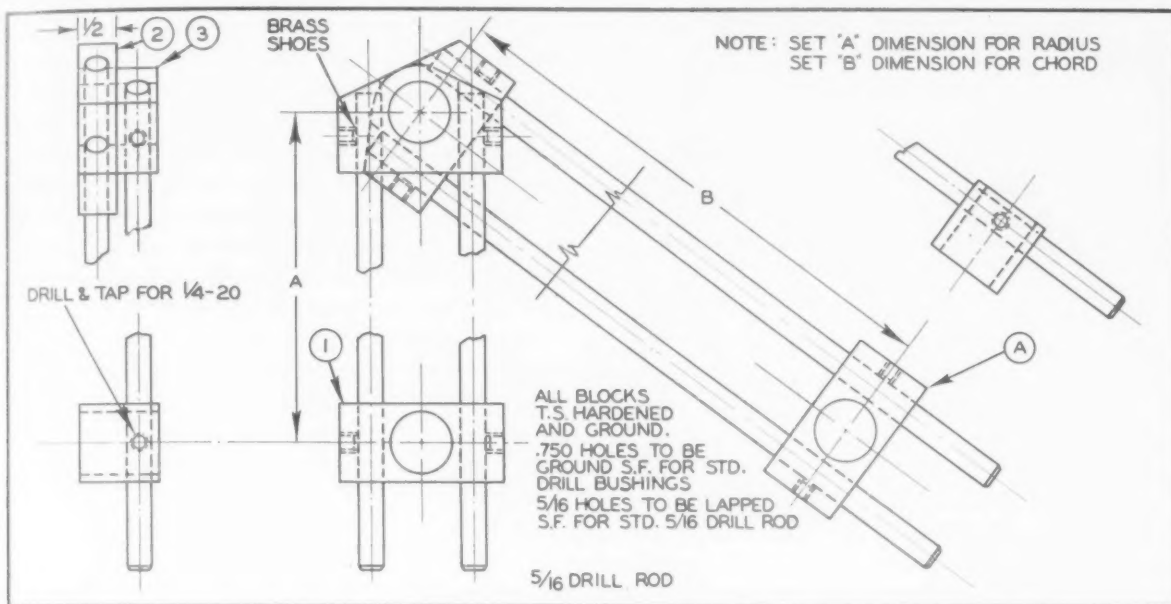
This month's cover shows high speed continuous surface broaching of automatic cylinder blocks, using carbide-insert broaches, on a Cincinnati Horizontal Broaching Machine.

Another Tool Engineering Report is scheduled for September issue, *The Tool Engineer*.

# Gadgets

Ingenious Devices and Ideas to Help  
the Tool Engineer in His Daily Work

## Tool for Accurate Hole Spacing



Holes may be accurately spaced and bored, in index plates, without resort to a jig borer, with a tool such as illustrated. Radii and chordal distances are established by "miking" between plugs.

While our jig borer was at the factory for overhauling, the writer had to accurately bore twelve holes, equally spaced on a 15 in. circle on an indexing milling fixture then under construction. The tool shown permitted accurate spacing of the circular hole pattern in a drill press.

First, we made up blocks 1, 2, 3 and 4 from tool steel, and bored a 0.0750 in. hole in each. Equidistant from the center line of this hole, we bored two 5/16 in. diameter holes in each block so that, when assembled on rods, all blocks were free to slide on the rods. As will be noted, blocks 2 and 3 were half the thickness of blocks 1 and 4, and rotated on a common center. After boring, the blocks were hardened and ground.

Assembling the several blocks on the rods—we used 5/16 in. dia. drill rod—we inserted a plug in compound block 2-3 and, from that point, established radius and chord to closest "tenth" with a micrometer. Next, we drilled and reamed a hole in the center of the plate—the center of the 15 in. circle—using standard drill bushings. We then centered block No. 1 on this hole and, using compound block 2-3, drilled and reamed the first of the 12 holes.

No. 4 block was then plugged into this hole and the second hole drilled and reamed from blocks 3-4, and so on around the circle. On completing

the twelfth and last hole, we found that the radius of all holes was identical and that the accumulated error, between holes, was only 0.0008 in.—well within prescribed tolerance. The tool is simple and provides a short cut to accurate hole spacing without resort to jig boring.

D. A. Coates  
San Diego, Calif.

## To Remove Broken Taps

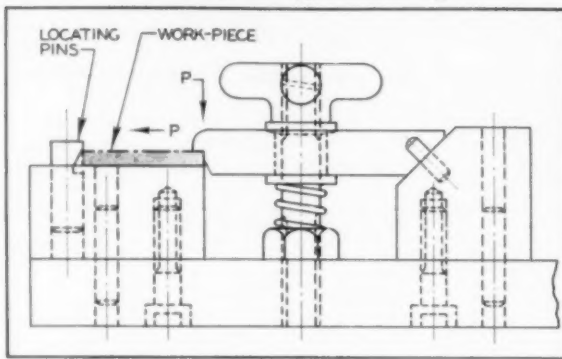
Unless a broken tap is so tightly jammed in the hole that it defies all but disintegration, the simple method here suggested will usually suffice for removal. Select wires which may be inserted in the flutes, and cut them about 6 in. long.

Loop the free ends of the wires, insert a short rod through the loops, and twist to unscrew the tap section. The wires, which may be annealed music wire or even section of a clothes hanger, depending on top size, will twist into a solid rod and should then exert enough torque to back out the tap.

Frank M. Butrick, Jr.  
Chapter 38, ASTE

**The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of \$5.00 for each item.**

## 45 Deg Angle Clamp



A clamp, provided with a 45 deg heel angle and seating on a block having a 45 deg angle, forces it downward and against the workpiece.

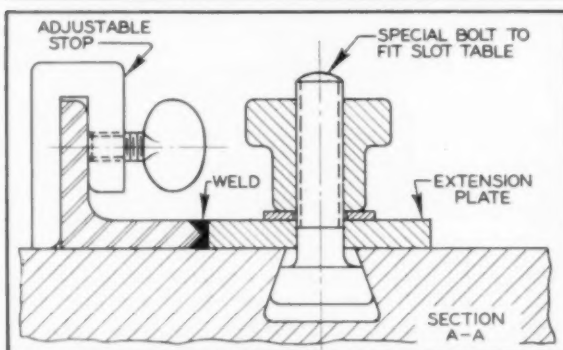
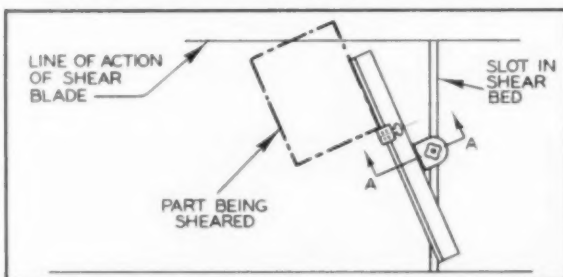
The illustration shows a clamp that not only holds the workpiece down on the anvil block but also forces it against a locating stop—pins or a set-edge—with the one turn of the hand knob. This double-acting feature is achieved by machining a 45 deg angle on one end of the strap, and another 45 deg angle on its seating block. The resulting pressure—p-p—is downward and against the workpiece. Outside of this feature, construction of the fixture follows conventional lines.

F. A. Adams  
Dayton, Ohio

## Angle Shearing Attachment

An economical "home made" attachment for angle shearing of sheets is shown in Figs. 1 and 2. It can be used to good advantage, with a squaring shear, for cutting corners from square plates and

A simple attachment for shears permits duplicate angle shearing of sheet stock, plate and flat bars. Fig. 1, at top, shows general assembly, and Fig. 2, at bottom, details of construction.



for shearing gussets and other angular shapes. When shearing flat stock into lengths with angular cut ends, the adjustable stop can be removed and the fixture used merely as a guide to produce the required angle. In such case, the lengths are controlled by the regular stops behind the shear blade.

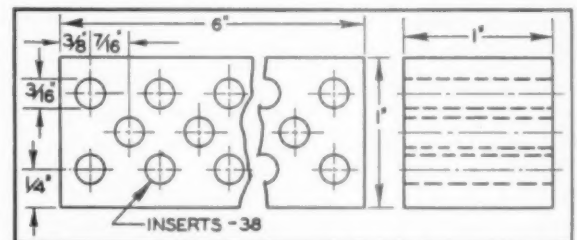
The attachment consists of a straight piece of 2 x 2 x 3/8 in. angle iron of the desired length. To this is welded an ear, scarfing the joint as shown in Fig. 2. The underside of the welded joint should be smooth to provide a flat seat on the shear bed and the weldment straightened if warpage has occurred. A hole, of a size to suit, is drilled in the ear. The attachment then rotates around a bolt, the head of which is machined to suit the slot on the shear bed. A hand knob and washer serves for clamping the attachment to the shear bed.

The adjustable stop is merely a slotted block, clamped to the angle iron guide by means of a thumb screw. The fixture as a whole is shown in its simplest elements and can be altered or modified to suit local conditions. In general principle, however, it is a cost and time saver.

Clement F. Brown  
Lima, Ohio

## "Magnetic" Parallel

The parallel illustrated, which is termed "magnetic" because it transmits most of the magnetic lines of force that would pass through it if placed on a magnetic chuck, is easy to make and quite practical to boot. They are usually used, in pairs, to hold steel parts which have projections or shoulders that precludes full contact on a magnetic chuck.



Brass parallels, with inserted carbon steel plugs, serve to hold parts with projections or shoulders to magnetic chucks.

To make a pair, select two pieces of square or rectangular brass, about 1 in. thick x 6 in. long and, using a scale and square, lay out a series of holes as shown. Drill the holes press fit for 3/16 dia. drill rod or high-carbon steel plugs, the length of which should coincide with the thickness of the parallels. Press the plugs into the holes, then mill and grind the working surfaces. It should be mentioned that these parallels were designed by Mr. Harry Livingston, a member of Hartford Chapter, ASTE.

Edward Diskavich  
Torrington, Conn.



## Chicago 1952 Exposition To Emphasize Daily Production Theme

**March Meeting to Reach New High of 36 Papers in Three-Way Technical Program  
Host Chapter Plans Plant Tours, Banquet, Ladies' Events, and Educational Display**

"THE 1952 Tool Engineers Exposition and ASTE 20th Annual Meeting at Chicago will coordinate exhibitor and member interest more closely than any similar dual event ever sponsored by the Society," Gardner Young of Pittsburgh, national program chairman, announced following a preliminary planning meeting at Hotel Stevens, May 18-19.

"Each day, from March 17th through the 21st," he explained, "will have a specific manufacturing theme. The technical speakers will tell engineers how to do it; the exhibitors will show them what to do it with."

This extra service to industry was developed in a two-day conference of the National Program Committee. The second day was devoted to a joint session with the host chapter committee, headed by Marshall Blu, tool engineer for Sears, Roebuck & Co.

According to the plans formulated, exhibits at the exposition will be classified into five groups. The generic field covering a group will be the headliner for one day. On each day at least three educational papers will be presented on subjects relating to such equipment. These talks will be slanted towards established theory and practice—not cur-

Above: Facing Chicago's waterfront Grant Park, the Stevens, world's largest hotel, was meeting place for ASTE National Program Committee and host chapter convention committees. It can accommodate thousands of visitors to Society exposition next March. Kaufmann & Fabry photo.

rent advances nor new developments. Thus show visitors can get the maximum in specialized demonstration and information in a minimum of time.

Held in the afternoon, the educational sessions will conclude with a discussion panel made up of users, equipment manufacturers, and materials suppliers in the field concerned. Members may submit questions in advance to be answered by panel speakers.

### Covers Current Developments

In addition, 21 talks on trends in technical subjects of current interest are to be given in five morning and three evening periods. They may include supplemental coverage of the theme of the day.

This group of lectures will be augmented by written discussions, distributed to the audience along with pre-prints of the featured papers.

Also on the program will be several symposia keyed to such Society activities as tool engineering education, research, and standards.

The exposition will be held at the

First Vice-President L. B. Bellamy looks over National Program Committee's plans for Society's 1952 meeting at Chicago. Committee members seated with him are, from left: T. C. Barber, Gardner Young, chairman, and Kenneth Riddle. Standing: H. E. Conrad, executive secretary; F. W. Wilson, technical director, and J. O. Horne, also a committeeman. Right: Marshall Blu, host chapter committee chairman, explains organization chart of committee responsibilities.



International Amphitheatre. Technical sessions and other meetings will take place in the adjoining Stock Yard Inn.

Participating in the meeting were: Thomas C. Barber of Chicago, James O. Horne, Rochester, N. Y.; Clinton J. Helton, Denver, Colo., and Kenneth Riddle, Philadelphia, all of Mr. Young's committee; Leslie B. Bellamy of Detroit, first vice-president; Harry E. Conrad, executive secretary, and Frank W. Wilson, technical director, both from ASTE headquarters at Detroit.

**A**PPROXIMATELY 30 members of the local committee and officers of neighboring chapters met with these men on Saturday morning.

#### Names Division Chairmen

Mr. Young assigned responsibilities for coordinating various divisions of the program as follows: Technical activities, Mr. Horne; social programs, Mr. Riddle, and supplementary activities, Mr. Barber.

Each division chairman presided during the discussion of committees under his direction, briefing his respective chairmen on their duties as they reported progress on assignments.

From a list of 60 companies submitted, a schedule of selected plant tours will be set up. Registration for this activity will be at the Amphitheatre, the Stevens and Palmer House hotels. Plant tour parties will be picked up at the downtown hotels and returned to the Amphitheatre. Visits to plants will be made only in the morning.

A banquet on Thursday evening, a ladies program, and an educational exhibit are among other events being arranged by the Chicago chapter.

#### Host Committees Attend

Chapter officers and convention committeemen present were: H. Dale Long, chairman; Alvin J. Winkler, secretary; Howard Ettinger, social programs; Richard W. Miller, banquet; Walter W. Haskins and Robert Norwalk, reception; Mrs. Richard W. Miller, ladies program; Clifford Ives, technical activities; Fred Rust, plant tours; H. H. Katz, educational exhibit; Frank Martindell and William L. Bengtson, technical sessions.

Gordon J. Benes, supplementary functions; George A. Rieke, transportation; Clare Bryan, W. O. Will, and Arthur Brehm, signs; Harry A. Paine, session arrangements; E. K. Dayne, registration; E. W. Dickett of Rockford, tickets; Arnold W. Blackshaw and Albert Clements, publicity; John H. Beck, budgets; Joseph K. Kayda, records and reports; H. Verne Loeppert, supplementary functions assistant and emergency; Harold G. Abbott, advertising, and Earl Potts.

Attendance included Fred J. Schmitt, Chicago national director, and the following officers of assisting chapters: George Torrence, chairman, and William Moreland, second vice-chairman, Rockford; C. Harold Arndt, program chairman, Racine; Robert Bayless, past chairman, Peoria; Walter Behrend, chairman, and Arthur Gudert, past chairman, Milwaukee.

Out of respect for Frank Martindell, who received word of the sudden passing of his wife, the meeting was adjourned shortly before completion of the agenda.

## Morse Elected President

Houston, Texas—George T. Morse Jr., who went to work for the Peoria Iron & Steel Co. as a clerk in 1928, became president and general manager of the company.

Mr. Morse was recently elected a rector to fill a board vacancy. Then the board elected him president and general manager.

In recent years Mr. Morse has been vice president in charge of industrial sales. He is a member of the Houston ASTE chapter.

## Chicago Sets Up Committee to Work on New Die Manual

Chicago, Ill.—To organize a program for gathering prospective material for the Society's proposed "Handbook on Metal-Stamping Dies," the Book Committee of Chicago chapter met May 17 at the Stevens Hotel with Frank W. Wilson, book editor from ASTE headquarters.

As outlined by Mr. Wilson, the book will be confined to dies for blanking, drawing, forming and assembly of metal products, exclusive of hot-work dies. It will include basic theory, design of stampings, types of dies, die elements, die classification, punch press data, and punch press attachments.

The manual is intended for practical use by experienced die men rather than as a textbook. Largely graphic, it will have a minimum of text. In numerous illustrations, it will feature typical dies of proved performance in each classification, with examples of unusual design and application. "Tricks" and "kinks" that have solved actual problems will be emphasized.

In appealing to chapters to form committees to collect material for the die manual, E. W. Ernst of General Electric Co., Schenectady, N. Y., chairman of the Society's Book Committee, says, "Out of the experience of all, a medium for exchanging outstanding die data will be produced for the benefit of all."

Present at the meeting were Dr. O. Ostergaard, chairman of the chapter committee, and Michael Romano, book editor of Harig Mfg. Corp.; William Shrode, Pioneer Tool & Engineering Co.; Stanley Suorek and Eugene Kruse, Western Electric Co.; Richard J. Okon, W. D. Allen Mfg. Co.; George Haley, Wilson Jones Co.; Oscar Mathisen, Victor Gasket Co.; John Brosheer, American Machinist, Inc.; John H. Beck, Motorola, Inc.

For a detailed prospectus of the ASTE die manual, write to: Frank W. Wilson, book editor, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

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Top: President J. J. Demuth introduces Greater Lancaster's charter officers before installing them. From left: Willis M. Houck, secretary; Erik E. Stacel, second vice-chairman; Joseph H. Resser, chairman; Mr. Demuth, Milton J. Grimes, first vice-chairman; Amos L. Kraybill, delegate; Lester E. Eastman, alternate, and Robert I. Shaub, treasurer. Seated, left: H. E. Conrad, executive secretary, and, right: Dr. Robert Eshleman of Franklin and Marshall College, guest speaker at the charter ceremony. Below: Part of the dinner group. Facing camera in foreground are visitors from Philadelphia chapter.

## Lancaster's 109 Members Chartered as 89th Chapter

Lancaster, Pa. — Pennsylvania's seventh ASTE chapter was chartered May 15 at Lancaster. The Keystone State now ranks with Ohio and Illinois, exceeded only by New York with its 10 chapters. The 109 charter members of the 89th chapter include 31 transfers from Central Pennsylvania, Philadelphia, and Baltimore chapters.

Following dinner at Wiggins Restaurant, Chairman Pro-Tem Joseph H. Resser, Sr., opened the meeting, reviewing the formation of the Greater Lancaster group.

### Resser Continued in Office

Introduced by Mr. Resser, Harry E. Conrad, executive secretary of the Society, conducted an election of officers. The entire slate of nominees was elected as follows: Chairman, Joseph H. Resser, designer, Armstrong Cork Co.; first vice-chairman, Milton J. Grimes, tool designer, Radio Corp. of America, and second vice-chairman, Erik E. Stacel, plant industrial engineer, Bearings Co. of America, all of Lancaster.

Also, secretary, Willis M. Houck, tool engineer, New Holland Machine Div., Sperry Corp., New Holland; treasurer, Robert I. Shaub, plant engineer, Stonzi & Sons Inc., Ephrata; delegate, Amos

L. Kraybill, tool engineer, Bearings Co. of America; alternate, Lester S. Eastman, abrasive engineer, Norton Co., and membership chairman, Raymond C. Moorhead, machine designer, Armstrong Cork Co., all of Lancaster.

After describing the Society's activities and the scope of its operations, President J. J. Demuth of St. Louis installed the newly-elected officers.

T. J. Donovan of Philadelphia, third-vice-president, made the charter presentation, and Emil Kitzman, area captain of the national membership committee, also of Philadelphia, presented the chairman emblem.

Chairman Resser then introduced the guest speaker, Dr. Robert F. Eshleman, professor of economics and sociology at Elizabethtown College.

### Economist Traces Human Progress

As he built a pyramid of wooden frames to illustrate "Levels of Human Development," Dr. Eshleman traced the progress of human life from primitive tilling of the soil to the machine age. Through mechanization, he pointed out, fewer people are needed to produce food. Those freed from this labor have developed other enterprises, thus building communities. In conclusion, Dr.

Eshleman compared the peak of the pyramid to the spiritual side of life.

Rev. Ira D. Lowrey offered the invocation and the Stevens Trade School of Lancaster furnished dinner music.

Guests among the 141 men present for the ceremony included: R. V. Showers, director of placements, Franklin and Marshall College, Lancaster; E. H. Markley, vocational director, Hershey Industrial School, Hershey, and John S. Stauffer, superintendent of Stevens Trade School, Lancaster.

### Neighboring Officers Are Guests

Also visiting ASTE'ers: Willard Griffith, chairman, and Howard Gross, secretary, of Philadelphia chapter; Arthur Diamond of the national education committee, and William Chalfont, both of Philadelphia; Charles W. Janus, first vice-chairman of Baltimore chapter; James Fairhurst, chairman, and Eugene Pelizzoni, past chairman, of Lehigh Valley chapter, and Burnell Stambaugh, first vice-chairman of Central Pennsylvania chapter.

Area industries are represented in the charter membership as follows:

Oral R. Allriedge, Joseph F. Armer, Parke C. Dunlap, William E. Edwards, C. Russell Frain, James M. Freidly, George E. Gallagher, John N. Harris, Henry N. Kline, Jr., Lester B. Martin, Nicholas Mazur, John P. Phelan, John R. Pizzola, Albert M. Reusing, William H. Robinson, John W. Benedick, Charles F. Brown, George J. Coil, John R. Folkeson.

\* \* \*

Charles F. McNulty, Raymond Newswanger, Norman W. Ressler, Robert L. Ressler, Charles T. Rose, Melvin Soltenberger, Lester S. Steffy, Truman Coy, Paul C. Dellinger, and William M. Diehm, all of New Holland Machine Div., Sperry Corp., New Holland.

James E. Boyer, Lawrence L. Brown, Charles R. Keller, William Noyes, Oscar H. Nuss, Edward C. Shaw, Raymond C. Moorhead, Martin Good, Hugh R. Grable, Victor B. Hensel, Levi B. Leisey, Walter A. Montgomery, and Carl W. Stehman, Armstrong Cork Co., Lancaster.

\* \* \*

George E. Danz, Gustavo G. Shaeffer, John G. Fish, Noah H. Groff, Ralph E. Morrison, Robert C. Ressler, John J. Warfel, and Ralph F. Wolf, Bearings Co. of America, Lancaster; John D. Herrington, Robert J. Leonard, Dennis P. McCreary, Leon W. Metzger, Robert H. Moser, George W. Rineer, and Richard J. Trumbower, Radio Corp. of America, Lancaster.

Joseph R. Centini, Charles L. Huber, Jack E. Humphreville, Albert L. Radcliffe, Kenneth R. Bernhardt, and Ralph B. Mentzer, Hamilton Watch Co., Lancaster; Michael W. Bigos and

Joseph D. Knauer, Sanders and Thomas, Pottstown; Joseph P. Dechert, Decherts Machine Shop, Palmyra; John M. Denuel and Richard L. Witmer, Stevens Trade School, Lancaster.

Ralph W. Deily, Mac It Parts Co.; George Q. Eurich, Slaymaker Lock Co.; Jacques A. Gammache and Vincent P. Gammache, Gam Manufacturing Co.; Gotthard Hagstrom, Safe Padlock Hardware Co.; Paul A. Herr, Lancaster Engineering Co.; Leland H. Hilton, Edward H. Koerkle, and Eugene B. Witmeyer, Thriftmaster Products, all of Lancaster; Daniel E. Funk, Wright & Gade Tool Co., Philadelphia.

\* \* \*

Harry D. Keefer, Byrl V. Laucks, and Paul D. Miller, Crescent Truck Co.; James F. Kercher, Kercher Machine Shop, and George F. Onfrey, Lebanon Steel Foundry, all of Lebanon; George L. McMichael, Industrial Abrasives Supply Co., Reading; Richard L. Peris, Conestoga Transportation Co., and Theodore R. Schwalm, Theodore R. Schwalm Co., Lancaster.

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Charles Smith, Otho B. Gill, and Richard A. Gill, Gill Rock Drill Co., Lebanon; C. L. Boughter, Sr., Hershey Machine Foundry, Manheim; Oden F. Blondell, O. F. Blondell Co., and Dexter W. Erline, Animal Trap Co., Lititz; David B. Frantz, Aircraft Marine Products Inc., Carlisle; Richard J. Gammache, Machinery Products Co., Lancaster.

Reynold E. Schenke, Reynold E. Schenke Co., Paradise; Paul T. Schick, Carboloy Co., Inc., Newark, N. J.; Martin M. Sensenich and Donald R. Nunemacher, Sensenich Corp.; J. P. Wilcox, Calder Mfg. Co., and Charles W. Fisher, C. W. Fisher Co., all of Lancaster.

The new chapter includes all of Lancaster County and surrounding territory east of the Susquehanna River.

## Loach Speaks Abroad In Metal Symposium

London, Eng.—William J. Loach, manager of carbide research for Firth Sterling Steel & Carbide Corp., McKeesport, Pa., presented his company's developments in heat resisting alloys at the recent World Metal Symposium sponsored by the British Iron & Steel Institute.

This exchange of scientific information is urgent in view of expanded requirements of the Atlantic Pact countries for jet engines, gas turbines and other high temperature applications.

The Pittsburgh chapter member extended his trip to France, Italy, Austria and Germany to visit carbide and steel plants and leading metallurgical research laboratories.

## Evansville to Be Host for South Central Fall Meeting

Evansville, Ind.—Twelve midwest chapters will gather October 19-20 at Hotel Vendome, Evansville, for an area conference in conjunction with the semi-annual meeting of the Society's board of directors.

Participants will include St. Louis, Dayton, Cincinnati, Peoria, Indianapolis, Nashville, Louisville, Decatur, Springfield, Ill., Richmond, Muncie, and Evansville chapters, with a special visiting invitation to Atlanta and Piedmont.

To plan this South Central Area meeting, key members of the National Program Committee met with Evansville chapter officers, May 20, at the Vendome.

According to the tentative program arranged by National Program Chairman Gardner Young of Pittsburgh, and the planning committee, two technical sessions and two plant tours will be scheduled Friday, the 19th, with a banquet in the evening. The board also will meet on Friday.

A third technical session will be held Saturday morning. During the day chapter executives will confer with national officers and committee chairmen or their representatives.

### New Chapter Sites Considered

In addition, the National Membership Committee is surveying the possibilities of chartering one or more new chapters in this area on or before the meeting. Towns such as Kokomo, Anderson, and Terre Haute, Ind., Owensboro and Paducah, Ky., are being considered as potential ASTE locations.

If sufficient attendance is indicated, the committee will arrange a ladies program. A lounge will be set up as a meeting place for the visiting women.

Registration fee will be \$1 for members and non-members alike. For the convenience of early arrivals, the registration desk will open Thursday eve-

ning. As a kick-off event, there may be an informal rally or smoker at the time.

Different from the one-day regional sessions previously held for chapter officers, this meeting is being developed along a new pattern, Frank W. Wilson, technical director, explained. A program announcement, with hotel room and banquet ticket reservation forms will go out to each of the approximately 2000 members in the chapters concerned.

### Wants Help of All Area Chapters

"In order to put across this section convention, our committee needs the cooperation, communication and participation of every chapter in our area," Charles H. Thuman, Evansville chairman, told the organization meeting. "We are only local agents and 'leg men' for the out-of-town groups." Mr. Thuman may be contacted at Seeger Refrigeration Co., 225 W. Morgan Ave., Evansville.

Others at the planning meeting were Howard C. McMillen of Evansville, national treasurer; Thomas Barber of Chicago, national program committee man; and the following Evansville officers and members: Henry J. Pernick, first vice-chairman; Bernard E. Pamp, secretary; Paul W. Vierling, second vice-chairman; Paul L. Wetzel, education chairman; Henry J. Appel, membership.

Russell H. Wiberg, program; Arthur Fritz, editorial and public relations; Walter V. Stippler, immediate past chairman; John E. Race, and Joseph Halbig.

### Before You Forget

Circle October 19-20

It's Your Date With ASTE  
At Evansville

## President Visits Dayton for May Anniversary Dinner

Several national officers were guests at Dayton's 13th anniversary meeting. From left: G. A. Goodwin, director-elect; J. J. Demuth, president; H. E. Conrad, executive secretary, and L. R. McAfee, chapter chairman.



‘20th Year. . .

## 20,000 Members’

### Clark Opens Campaign for 2,000 More ASTE’ers Other Chairmen Name Committeemen, Plan Activities

IN EVERY ASTE TOWN top management personnel and qualified tool engineers are being invited to join the Society. New areas are being investigated

as prospective chapter locations. Some already are approaching charter strength. Chapters are following up on meeting guests and registrants at recent expositions and conventions.



A. B. Clark

It’s all part of the Society’s program to organize and coordinate the production knowledge needed to keep both armament and civilian goods production lines moving.

An average net membership increase of 20 percent is the quota assigned to chapters by Andrew B. Clark of Cleveland, national membership chairman.

#### Emphasis Is on Quality

“In working towards our goal, ‘20th year—20,000 members,’” Mr. Clark cautioned, “applications should be screened from the standpoint of quality, with quantity a secondary consideration.” As a constant reminder of the committee’s target, membership application forms have the new slogan overprinted in red.

At a recent meeting in Detroit with Thomas J. Donovan of Philadelphia, third vice-president in charge of membership, the National Membership Committee developed its campaign plans. As a special service, the committee will present to each chapter membership chairman a kit for application blanks, promotional literature, ASTE pins, samples of *The Tool Engineer*, data sheets, “Tool Engineers Handbook,” and other services.

Identified with an ASTE emblem design, the fabric-covered, leather-bound case is approximately 15 x 30. A photo showing suggested lettering will accompany the case. When it has been marked and filled out, the area captain for the National Membership Committee will

visit the chapter and formally present the kit.

Area captains appointed by Mr. Clark and the chapters under their respective supervision are: Thomas C. Bradford, Worcester, Mass.—Boston, Fairfield County, Hartford, Little Rhody, New Haven, Portland (Me.), Springfield (Mass.), Syracuse, Twin States, Granite State, and Worcester.

A. B. Clark, Cleveland, Ohio—Akron, Buffalo-Niagara Frontier, Erie, Pittsburgh, and Cleveland.

Ben J. Hazewinkel, Denver, Colo.—



A kit, to carry samples of Society services, literature, and application blanks, will go to each chapter membership chairman, as a gift of the national committee.

Golden Gate, Long Beach, Los Angeles, San Diego, Seattle, and Portland (Ore.).

Warren L. Foss, Denver, Colo.—Houston, North Texas, Wichita, Salt Lake City, and Denver.

Erwin Huchzermeier, St. Louis, Mo.—Decatur, Evansville, Peoria, Springfield (Ill.), Kansas City, and St. Louis.

Emil Kitzman, Philadelphia, Pa.—Baltimore, Central Pennsylvania, Long Island, Greater New York, Lehigh Valley, Northern New Jersey, Potomac, Williamsport, and Philadelphia.



William W. Schug, Hudson, N. Y.—Binghamton, Elmira, Rochester, Mohawk Valley, Schenectady, and Mid-Hudson.

Robert W. Miller, Cincinnati, Ohio—Atlanta, Columbus, Dayton, Indianapolis, Louisville, Muncie, Nashville, New Orleans, Piedmont, Richmond, Springfield (Ohio), and Cincinnati.

Oliver J. Onken, Chicago, Ill.—Cedar Rapids, Des Moines, Fond du Lac, Fort Wayne, Fox River Valley, Madison, Milwaukee, Racine, Rockford, South Bend, Tri-Cities, Twin Cities, and Chicago.

\* \* \*

Gerald A. Rogers, Montreal, Que., and Harry H. Whitehall, Galt, Ont.—Grand River Valley, Hamilton, Niagara District, Toronto, and Montreal.

Charles S. Smillie, Detroit, Mich.—Jackson, Pontiac, Saginaw Valley, Toledo, Waterloo Area, Western Michigan, Windsor (Ont.), and Detroit.

**ACTIVITIES UNDERWAY** by the National Program Committee and the Book Committee are reported elsewhere in this section. Other committees are scheduling summer meetings to organize, or to continue programs already in work.

Personnel of these committees and their respective chapter affiliations follow:

**Book**—E. W. Ernst, chairman, Schenectady; Jay Bowen, Detroit; Ben C. Brosheer, Chicago; Frank W. Curtis, Springfield (Mass.); Gordon Swarsenski, Peoria, and Frank W. Wilson, editor, American Society of Tool Engineers, Detroit.

\* \* \*

**Constitution and By-Laws**—Dick R. Lynch, chairman, Los Angeles; Edward J. Berry, Little Rhody, and Edward H. Ruder, St. Louis.

**Editorial**—W. F. Sherman, chairman, Detroit; Joe Penn, Indianapolis; Joseph L. Petz, Mid-Hudson; Paul F. Rehner, Detroit; Milton L. Roessel, Rochester; D. F. Saurenman, Houston, and A. M. Schmit, Toledo.

**Education**—Jay N. Edmondson, chairman, Columbus; Arthur R. Dia-



W. F. Jarvis



Gardner Young



R. C. Peterson



W. G. Ehrhardt



E. W. Ernst



W. F. Sherman



A. M. Sargent



R. I. Robbins



J. N. Edmondson



D. R. Linch

mond, Philadelphia; C. Douglas Wright, Niagara District; M. L. Bege- man, Houston, and W. W. Gilbert, Waterloo Area.

**Finance**—William F. Jarvis, chair- man, Hartford; Howard C. McMillen, Evansville; Dan Wesson, Springfield, Mass.; Harry R. Nelson, Chicago, and Milburn Ross, Wichita.

\* \* \*

**Professional Engineering**—Ralph I. Robbins, chairman, Boston; W. A. Daw- son, Hamilton; A. M. Sargent and G. S. Wilcox, Jr., Detroit; Edgar J. Seifreat, Dayton; L. G. Singer, Toronto, and Paul R. Weitzman, Fort Wayne.

**Program**—Gardner Young, chair- man, Pittsburgh; J. O. Horne, Roches- ter; Thomas C. Barber, Chicago; Clin- ton J. Helton, Denver, and Kenneth W. Riddle, Philadelphia.

**Public Relations**—Willis G. Ehr- hardt, chairman, St. Louis; R. Eric Crawford, Toronto; Carl C. Harrington, Greater New York; Leslie F. Hawes, Los Angeles; Charles O. Herb, North- ern New Jersey; Guy Hubbard, Cleve- land; Halsey F. Owen, Indianapolis; J. D. Schiller, Piedmont, and J. A. Wood- man, Granite State.

\* \* \*

**Standards**—Raymond C. Peterson, chairman, Toledo; Joseph C. Brenner, Greater New York; William Moreland, Rockford; Arthur M. Swigert, Leslie B. Bellamy, and Grant S. Wilcox, Jr., De- troit, and Owen E. Harvey, Cleveland.

**Tool Engineering Research Fund** —A. M. Sargent, chairman, Detroit; Orlan W. Boston, Waterloo Area; Jay N. Edmondson, Columbus, and William H. Smila, Detroit.

Get One

NEW MEMBER

This Summer

## Home Chapter Honors Demuth on Presidency

St. Louis, Mo.—J. J. Demuth, ASTE president and a member of St. Louis chapter, was recognized on his election to the Society's highest office, at the chapter's April 5 meeting.

Before 110 members and guests present for a dinner and technical session at the DeSoto Hotel, Willis G. Ehrhardt, national public relations chairman, presented Mr. Demuth with a set of luggage on behalf of the chapter.

James Meehan, sales manager for the Grinding Division of Brown & Sharpe Mfg. Co., was guest speaker. He dis- cussed methods of obtaining a good finish by grinding, and research pro- jects that have improved grinding ma- chines and accessories.

## Pontiac Gives Students Visual Training Program

Pontiac, Mich.—Evening students of the Vocational Department of Pon- tiac High School have completed a vis-

ual training program conducted as an educational project of Pontiac chapter.

Largely drawn from the apprentice schools at Pontiac Motors and General Motors Truck and Coach Division, the students were shown selected industrial films once a month through the 1950-51 term. During these sessions an average attendance of 60 to 70 students was maintained.

The motion pictures were presented the second Monday of each month as follows: November—"The Making of Alloy Steels," Bethlehem Steel Corp.; December—"Safe As You Think," Gen- eral Motors Corp.; and "Electronics at Work," Westinghouse Electric Corp. January—"Buick Cylinder Head Trans- fer Machines" and "Building a Spindle Automatic Turret Lathe," Greenlee Bros. Corp.

February—"Drama of Portland Ce- ment," Portland Cement Association; March—"Kingdom of Plastics," Gen- eral Electric Corp. and "Scientific Ap- proach to Better Plastics," Society of the Plastics Industry; April—"By The Works," General Electric Co., and May—"Highway to Production," Cincin- nati Milling Machine Co. and "Las- Date," Lumberman's Mutual Casualty Co.

Ralph H. Pardee, education chair- man, with D. C. Inman and Lloyd W. Pardee of this committee, had charge of the program.

Instructors Graff and Snively of the high school faculty cooperated in the selection of subjects and in the phys- ical arrangements.

## Flint Automotive Experts Head Pressed Metal Panel

Five General Motors engineers discussed Pressed Metals at the April 19 meeting of Saginaw Valley chapter. From left: John Puderbach, Fisher Body Div., Plant No. 1; Ronald Warner, Chevrolet Motor Div.; Edward Reed, General Motors Institute; Clifton Geddis, Buick Motors Div.; A. E. Rylander, technical editor of *The Tool Engineer*, who moderated panel, and Walter Hanna, AC Spark Plug Div.





Headquarters mail is swelled by thousands of constitutional amendment ballots. Left: Edward Kneip, mail room supervisor, drags in another bagful of votes. Center: H. E. Conrad, executive secretary, stacks ballots

as Anna Raeder, mail clerk, opens them. Right: Serving as official tellers, George Squibb (left), Detroit constitution and by-laws chairman, and Edward Wiard of his committee, check returns.

## Members Vote to Establish Basic Research Project

Backed by membership approval, the Society will begin its program of basic research in tool engineering. The three constitutional amendments required to legalize the project have been ratified, along with eight others recently submitted for referendum vote, W. A. Thomas, national secretary, has announced.

The first three amendments authorize the board of directors to appoint a Research Fund Committee, and make the latter autonomous in the administration of its funds. Such grants, whether contributed by ASTE or by industry, are separate from the Society's property.

### Age Requirement Lowered

In additional ballot actions: the minimum age for senior membership is lowered from 25 to 21, and its voting and ownership rights are established. Qualifying students can be assigned only to student membership. The age limit for this grade is removed to accommodate students older than 20 years, but ineligible for junior or senior membership.

In the event of re-election, a past president becomes eligible for life membership after a "term" rather than a "year" of service. To provide against a vacancy in the presidency, the election of a first vice-president is made mandatory.

Members must accept the highest grade of membership to which they are qualified. The final change corrects a

clerical error in the wording of the procedure for processing constitutional amendments.

Already screened by chapter constitution and by-laws committees, all of the proposals were carried by overwhelming majorities.

During the voting period the bulging mailbags of ballots being returned to national headquarters necessitated extra trips to the post office.

Appointed tellers by President J. J. Demuth, George A. Squibb, chairman of the Detroit Constitution and By-Laws Committee, and Edward D. Wiard of his committee tabulated the results of the thousands of votes.

## Past Chairmen Honored By Fort Wayne Members

Fort Wayne, Ind.—May 9 meeting of Fort Wayne chapter was designated Past Chairman Night. Paul Weitzer, Emil Mellon, John Davis and LaMar Brandt, the honor guests, reminisced about chapter activities during their terms in office.

Professor Minard Rose of Tri-State College, Angola, reviewed the work of the student section. Attendance included the following ASTE members of the June graduating class: Winton McColl, chairman; Richard Keehn, Gay Kassab, secretary-treasurer; Norman Wehrmeister, Don Hawk, Morris Wal-

ters, corresponding secretary, and John Skurat.

Two films, "Everyday Miracles" by Carboloy Co. and "Grinding of Carbide Tools" by Norton Co., constituted the technical session. Al Olson, a local sportsman, showed a motion picture depicting hunting and fishing in Pennsylvania and British Columbia.

Dr. H. B. OSBORN, JR., technical director of Tocco Div., Ohio Crankshaft Co., and assistant secretary-treasurer of ASTE, gave his lecture on Induction Heating before the chapter on April 11.

In addition to reviewing the evolution of the process, Dr. Osborn cited several case histories of the role induction heating played in World War II production.

During the evening Ralph Didier, chapter chairman, presented a past chairman pin to LaMar Brandt, his predecessor in office.

Left: Fort Wayne chapter gives a hand to its student section members graduating from Tri-State College. From left: Richard Keehn, Gay Kassab, secretary-treasurer; Norman Wehrmeister, Winton McColl, chairman; Don Hawk, Morris Walters, corresponding secretary, and John Skurat. Below: Ralph Didier, chapter chairman, pins a past chairman emblem on LaMar Brandt.



## Fox River Honors Graduates of Chapter T. E. Course

St. Charles, Ill.—Forty Fox River Valley members who recently completed a chapter-sponsored course in tool engineering were dinner guests at the chapter's May 1 meeting at Hotel Baker.

Employed by 15 of the largest industrial firms in the area, the men have been studying the latest design methods, as well as production costs. Since applicants far exceeded the teaching facilities available, another class is being considered for the fall season.

Members of the first class were: D. W. Mallincoat, Gerald B. Stone, Hansel Murley, David A. Grobb, and Dan W. Reusche, All-Steel Equipment Co.; John Popp, Jr. and Charles J. Frye, Aurora Pump Co.; Merle A. Hayward and Ralph H. Keck, Aurora Metal Co.; LeRoy Calkins, Barber-Greene Co.; Linus D. Reed, McKee Door Co.; William A. Osterland, Clarence T. Streit, and Don Molander, Pines Engineering Co. \* \* \*

Marion C. Mulcay and Harold K. Dudley, Richards-Wilcox Mfg. Co.; Robert I. Evans, Jack C. Dean, Dean D. Keck, and William H. Kelley, Stephens-Adamson Mfg. Co., all of Aurora; Wilbur H. Thies, Earl A. Carpenter, Donald Smith, Raymond M. Kastoll, Sidney S. Erickson, and Paul A. Rosene, Burgess-Norton Mfg. Co.; A. L. Lynch, Nicholas Accoria, Everett Harris, and William J. Sprigings, Dunbar-Kapple Co., all of Geneva. \* \* \*

Harold A. Zimmerman, Blaney B. Blay, and Shepley Winter, Elgin National Watch Co.; Walter D. Phillips, Otto C. Meglin, and Lester R. Hill, Phillips Auto Parts Co., all of Elgin; Joseph Zoda, Walter Foulkes, and Donald Jensen, Hawley Products Co. and David Evans, Operadio Mfg. Co., all of St. Charles; and Willard C. Perkins, Jr., Lakeside Mfg. Co., Crystal Lake.

Samuel E. Rusinoff, instructor for the 16-week chapter course and professor of mechanical engineering and manufacturing processes at the Illinois Institute of Technology, addressed the meeting on "Progress in Precision Casting."

Applications of the process and alloys were demonstrated.

In a subsequent question and answer period, Professor Rusinoff was assisted by Professor Chester A. Arents.

**PAUL REHNER** of Allegheny Ludlum Steel Corp. was technical speaker at the April 3 meeting. His subject, "Carbide Tools," was illustrated with sectional dies having multiple openings of unusual shapes, and the accompanying punches.

## Will Represent Horton

Windsor Locks, Conn.—Donald B. Hunting, immediate past chairman of Hartford chapter, has been appointed sales representative in the Cincinnati area by E. Horton & Son Co.

Associated with the chuck industry for the past 17 years, Mr. Hunting has served in production, engineering, and management capacities. He is establishing an office in the Cincinnati area and a residence in the Stockton section of Hamilton, Ohio.

## Position Available

### ASSISTANT MASTER MECHANIC

—Detroit client requires young engineer with stamping experience. Excellent opportunity with a sound company. Arnold W. Brady & Associates, management consultants, 2455 Guardian Bldg., Detroit 26, Mich. Tel.: WO 2-4455.

## Situation Wanted

**TOOL ENGINEER**—Experienced supervisor of jig, fixture and cutting tool design. Also processing methods, tool and equipment cost estimating for mass production and/or job shop work. Registered Mechanical Engineer, age 31. Address Box 237, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Members of Fox River Valley tool engineering course were recent dinner guests of the chapter.

## Better Material Handling Could Save Billions

Cedar Rapids, Iowa.—By improving material handling methods, American industry could save two billions of dollars in annual expenditure of 35 billions for plant operations.

To support this estimate, Clarence T. Houston, manager, Hyster Co., Peoria, Ill., gave rules for reducing material handling costs.

Speaking before Cedar Rapids chapter, April 18, Mr. Houston went on to describe, and illustrate with models, the three basic devices for mechanical handling of materials—conveyors, cranes and hoists, and industrial trucks.

Showing slides, he cited several case histories of handling problems and the solutions.

A discussion period concluded the session. Mr. Houston was presented by W. D. Popek, chapter chairman, and assisted by Armand Pillon, Hyster sales engineer.

During the coffee period Jim Meaghan, general manager of the Cedar Rapids Indians baseball club, spoke formally on public relations and how the Indians improved their acceptance in the Cedar Rapids area. R. L. Corner, second vice-chairman, introduced Mr. Meaghan.

Guests included E. H. "Dutch" Leisen, former big-league baseball pitcher and Hector "Pepino" Azamar, Mexican pitching star.

Clarence Houston (left), Hyster Co. speaker, answers a question for Calvin H. Ling of Rapids Gas Specialties Co., following talk on material handling at Cedar Rapids.





Charter members and past chairmen were Old Timers' Night guests of Cleveland chapter. From left, front row: Christy Schron, Wilbur Todd, John Fitzsimmons, Rudolph Fintz, Charles Kotersal, and Paul Rossbach. Back row: Jack Schron, Charles Scheihing, Joseph Karash, William Guzik, William Reiff, Glenn Hier, and Stephen Hendreich. Left: John H. Bromelmeier of Case Institute of Technology receives chapter's annual \$500 scholarship award from John Lucas, Yoder Co. president, and chairman of the Scholarship Selection Committee.



## Cleveland Scholarship Awarded to Bromelmeier

Cleveland, Ohio—John H. Bromelmeier of Case Institute of Technology has been awarded Cleveland chapter's annual \$500 scholarship. The award was presented to Mr. Bromelmeier at the chapter's 16th anniversary Old Timers' Night, May 11. All charter members and former chairmen were invited as guests.

John Lucas, president of The Yoder Co. made the presentation. Mr. Lucas served as chairman of a Selection Committee composed of five prominent industrialists.

## Explain How to Decide On Machining Method

Peoria, Ill.—"Broaching vs. Milling" was weighed by Robert A. Winblad and Al Heckman, mechanical engineers from Cincinnati Milling Machine Co., at the May 8 dinner meeting of Peoria chapter, held in Morton.

Their presentation was not a debate but rather an explanation of how their company determined which method is preferable. A profitable question and answer period followed the discussion.

Robert J. Conwell, Caterpillar Tractor Co. planning superintendent, acted as technical chairman.

## Industry Gains Benefits From ASTE Employees

Madison, Wis.—From a purely selfish standpoint, management should encourage engineering employees to join ASTE. Benefits gained by the individual member, through attendance at tool shows, conventions, chapter technical sessions, as well as from the Society's magazine and other services, will accrue to industry in better products engineered at lower cost.

Speaking May 8 before Madison chapter's Past Chairmen and Executives Night meeting, A. E. Rylander, technical editor of *The Tool Engineer* drove home this point to area industrialists. Manufacturing executives in the audience came from as far as Chicago, Milwaukee, Rockford and Fond du Lac.

### McClellan Compliments Chapter

A surprise visitor, Director-Elect W. B. McClellan of Detroit also spoke, complimenting the chapter on its educational projects, member interest, and efficient operation.

As the technical feature, Gunnar Danielson and Vincent Peterson of O'Neil-Irwin Mfg. Co. demonstrated their company's die-less duplicating equipment. Mr. Danielson lectured on the operation and application of these machines and tools.



## A Medal for You

If you've found a new way of using arc welding in the field of tool engineering, your paper may win the annual James F. Lincoln Award open only to ASTE members.

This competition closes November 15, so send today for details and rules. Just fill in and mail the form below.

ASTE Honor Awards Committee,  
10700 Puritan Ave., Detroit 21, Mich.

Please send me Lincoln Award rules.

Name .....  
Street Address .....  
City ..... Zone ..... State .....

## New Haven Members See How Engineering and Research Put Hardware Firm on Profitable Production Basis

New Haven, Conn.—How organization of a production engineering and research department put a hit-or-miss handicraft industry on a standardized production basis was described by a hardware company official and demonstrated in a plant tour for New Haven chapter.

Approximately 140 members were dinner guests at Sargent & Co., April 17, prior to an evening program and plant inspection.

In the complete changeover of manufacturing procedure, the product engineer, the tool engineer, and the process man work as a team, Samuel Oxhandler, assistant manager and chief engineer of the production engineering department, told the visiting ASTE'ers. Tooling is thus developed at minimum cost.

### Workers Were Individualists

Formerly the pattern maker frequently developed the product. He labored in secrecy, locking up his work at night. There was no thought of uniformity or standardization. Rejects were high and returns of unsatisfactory merchandise even higher.

But with modern engineering the company has been able to meet the competition and make a reasonable profit, despite increasing costs of material and labor, according to the speaker.

Stanley R. Cullen, assistant works manager and director of industrial relations at Sargent, welcomed the tool engineers.

John Brozek, the technical chairman, introduced Mr. Oxhandler and Mr. Cullen, and organized the party in small groups for the plant visitation. In a five-mile tour the tool engineers viewed the press room, door closer, lock, cylinder and padlock machining; the screw machine department, and finishing operations.

**ERIE, PA.**—Material handling as a cost reduction factor in manufacturing slide fasteners was the theme of a field trip Erie chapter made May 1 to the plant of Talon, Inc., Meadville.

After dining at the Lafayette Hotel as guests of Talon, the members were welcomed by G. S. McKee, vice-president and works manager, who outlined the tour. R. J. Wilson, Jr., chapter chairman, presided over a business meeting.

Gleason W. Starn, a member employed at Talon, introduced C. E. Blass, planning manager, who outlined means and equipment used in plants of the company and its suppliers, to direct the efficient flow of materials. Slides supplemented his description.

A guided tour of the Talon plant and warehouse followed, ending with coffee in the cafeteria.

Mr. Starn and the Meadville members assisted in arrangements for the meeting.

**LONG BEACH, CALIF.**—For their May 9 meeting 88 Long Beach tool engineers were dinner guests and plant visitors at Byron Jackson Co. of Los Angeles. William J. Taylor welcomed the group on behalf of the company.

Two films, illustrating applications and unique design features of deep well submersible and double case double



From left: G. J. Walkey, Los Angeles chairman; John Gibson of Modern Tooling Corp.; Wayne Ewing, immediate past chairman, and Carl Almquist, program chairman, get together during Los Angeles chapter tour of the Modern Tooling plant.

volute pumps, were shown after dinner. Following the motion picture briefing, company guides escorted the members through the plant in small groups.

Interest centered around machining operations on the large, complex inner case castings for double case pumps. A small scale model of this pump was exhibited and disassembled to show its construction.

Largest of its kind, the plant's hydraulic laboratory has a 30-foot-deep test tank beneath the floor, containing 400,000 gallons of water.

**MONTREAL, QUE.**—Nearly 350 Montreal tool engineers went through the Harrington Tool & Die Co. plant, April 8.

The tour gave the members an insight into die design for disposable aluminum pie plates and silver flatware, as executed in one of Canada's better production shops.

Charles E. Herd, consulting engineer for the Hydraulic Division of Dominion

Engineering Co., lectured on "Training Young Draftsmen." Using slides he showed what could be accomplished in from three to six months' training. Each student, he cautioned, must be treated as an individual. More young men urgently needed to train for the engineering profession, he added.

**LOS ANGELES, CALIF.**—Opportunity to see one of the most up-to-date tool shows on the West Coast was seized by 150 Los Angeles members, when the chapter staged a tour of the Modern Tooling Corp. plant on May 10.

High spot of the visit was the outstanding jig boring equipment, enclosed in air conditioned rooms. Guides explained in detail the phenomenal tool

ances held and the operation of every machine.

John Gibson and Edward Riddle, ASTE members of the Modern Tooling staff, were hosts for the evening. Dinner at the nearby Industry Club preceded the tour.

**DAYTON, OHIO**—Cardner Board & Co. Co., Middletown, was host to Dayton members, April 9, for a tour of tool making.

Before the tour, the party stopped at the Manchester Hotel for dinner and business meeting. L. R. McAfee, chapter chairman, presided.

**MILWAUKEE, WIS.**—More than 50 Milwaukee ASTE'ers saw the high speed assembly of metal containers at American Can Co., following the April 12 meeting. Employees acted as guides and answered questions about operations. The meeting opened with dinner in the plant cafeteria.

## Special 'Skin Miller' Built for Aircraft Firm

Fond du Lac, Wis.—A special "skin miller," built for Lockheed Aircraft Co., was described for Fond du Lac members at the May 11 dinner meeting at Bernard Hall. The speaker was Jesse Dougherty of Giddings & Lewis Machine Tool Co.

Following Mr. Dougherty's address, W. B. Rutz presented and narrated a film, "Mexico Today."

During a business meeting conducted by Charles Billberg, chairman, the members voted to have H. J. Van Valkenberg, education chairman, form a committee to organize a student section.

Dr. A. O. Schmidt of Kearney & Trecker Corp., Milwaukee, lectured on "Milling by Modern Techniques" at a meeting held April 13 at Mae Drury's, Green Bay.

John Bahr, chapter delegate, reported on the house of delegates meeting at the New York convention and Harry Soukup, membership chairman, outlined plans for a membership drive.

In the absence of Chairman Billberg, Erwin Kaiser, first vice-chairman, presided.

## Methods Drawings Show Rock Drill Production

Springfield, Vt.—The development of carbide matrix diamond drills for mining and deep well oil drilling, from the time of diamond hand setting to modern production methods, was related to Twin States members, May 9, by O. E. Olivieri, chief engineer and plant manager of J. K. Smit & Sons, Inc. Mr. Olivieri spoke at the final technical session of the season at the Trade Winds Cafe.

His freehand drawings of infiltration and resistance methods of manufacturing these drills highlighted the discussion.

## Explains Defense Production Act

Robert Laffin, first vice-chairman, introduced Mr. Olivieri, and Floyd McArthur, chairman, presented Everett C. Williams, a Springfield attorney, as coffee speaker. Reporting on a recent Harvard Law School forum on legal problems of mobilization, Mr. Williams outlined the Defense Production Act. He also explained the expected operation and effects of the controlled materials plan.

Visitors, among the attendance of 70, were welcomed from Claremont and Nashua, N. H.; Springfield and Danby, Vt.; Natick, Newton Center, Boston, Greenfield and Wrentham, Mass.; Hartford, Conn.; Murray Hill, N. J.; Florence, Italy, and Stockholm, Sweden.

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Evansville members line up to try welding torch demonstrated by J. R. Koske of Eutectic Welding Alloys Corp., for tool salvage.

## War-Bound Students Thank Evansville for Privileges

Evansville, Ind.—Three student members of Evansville chapter bade the Society farewell at the April 9 meeting at Evansville College. James Bennett, Andrew Taylor and Victor Campbell are leaving college to learn the arts of war. As spokesman, Mr. Bennett thanked the chapter for the educational opportunities they had enjoyed.

J. R. Koske, regional sales manager for Eutectic Welding Alloys Corp., discussed "New Welding Methods and Techniques for Salvaging Tools and Dies." Mr. Koske gave actual demonstrations and showed slides.

Preliminary to the technical program, Bud Swope of the Evansville Manufacturers and Employers Association

presented a sound film, "Meet Evansville Industry."

Howard McMillen, a chapter member recently elected national treasurer, reported on the proceedings at the New York convention.

Arthur Greer was program chairman. Fifty-seven members were present and 10 guests were introduced.

**FREDERICK TURNER**, manager of industrial sales for the Osborn Manufacturing Co., Cleveland, Ohio, addressed the



From left: Frederick Turner, Wilhelm Wulf and Earl Stribinger of Osborn Mfg. Co. display power brushes during Evansville chapter program in which Mr. Turner discussed applications.

members and guests attending the May 14 meeting. Mr. Turner described and demonstrated new techniques and applications of power brushes in industry.

Coffee speaker was William Cousins, business manager of the Evansville Braves baseball team.

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Des Moines members keep Gordon T. Rideout of Norton Co. answering questions on titanium until nearly midnight.

### Reports on New Abrasives

Des Moines, Iowa—A Des Moines chapter audience learned "What's New in Abrasives" from Gordon T. Rideout, chief field test engineer for Norton Co., as he addressed an ASTE meeting, April 30, at Hotel Kirkwood.

As an additional impromptu feature, Mr. Rideout discussed Titanium, a subject which kept the tool engineers asking questions until nearly midnight.

Before the meeting opened, dinner was served to the 68 men.

### Westinghouse Assigns Phillips to New Post

E. Pittsburgh, Pa.—T. I. Phillips, vice-president of the Westinghouse Electric Corp. and formerly in charge of the company's E. Pittsburgh divisions, has been assigned to the staff of John K. Hodnette, industrial products vice-president, to help plan and carry out the firm's extensive industrial products expansion program.

The new assignment was announced by Mr. Hodnette, who said it was made in order to take full advantage of Mr. Phillips' 36 years of broad Westinghouse experience.

A Pittsburgh chapter member, Mr. Phillips was born in London, England, and was educated in the public schools of Lynn, Mass.

### Buckeye Names ASTE'ers

Dayton, Ohio—Earl Hamilton was elected secretary, and E. B. Meynard was appointed sales manager of Buckeye Tools Corp. at a recent meeting of the board of directors.

Both men are members of the Dayton ASTE chapter.

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## Nearly 300 Canadians Enjoy Ladies Night Party

Hamilton, Ont.—Two hundred and seventy-four persons taxed the capacity of the Burgundy Room at Fischer's Hotel for Hamilton chapter's annual ladies night, April 19.

Following dinner John Yorick, chairman, welcomed the group. Mrs. Yorick responded to a toast to the ladies, proposed by George Churchill, retiring chairman. An electric toaster was presented to Mrs. Churchill.

Mrs. H. B. Ward, wife of the editorial chairman, won the radio awarded as



door prize. A golf club for the woman claiming the best score went to Mrs. Albert Mitchel.

During the spot and elimination

Hamilton members entertain their ladies with annual dinner and dance.

dances, more prizes were distributed. After identifying the mysterious "M and Mrs. Atlas" as the Gordon Hall Sidney Dunn and Mrs. Robert Hall were awarded alarm clocks.

Frances Foster and the Jack Gordon Trio entertained and Floyd Roberts and the Burgundy Room orchestra played for dancing. John Morice, entertainment chairman, emceed the party.

**LOS ANGELES, CALIF.**—For the first meeting of his administration, G. Walkey, Los Angeles chapter chairman, found himself host to 830 members and guests attending the chapter's annual stag. Devoted to entertainment and refreshments, the party was held April 18 at the Old Dixie.

Gerald Stronks was in charge of ticket distribution for the successful affair.

**NASHVILLE, TENN.**—Highlight of Nashville's April 17 dinner meeting at the Andrew Jackson hotel was a report on the New York convention by Fred Wright, chapter delegate. A sports film concluded the meeting.

**INDIANAPOLIS, IND.**—The extensive preparations required for running the annual 500-mile automobile race at the Indianapolis Speedway were followed by Indianapolis members as they viewed a film.

As guest speaker at Indianapolis chapter, Herman Deupree of the Indianapolis Speedway described preparations involved in presenting the Memorial Day automobile race. Right: "Just what I wanted" is Lee M. Feeney's reaction to door prize award of "Tool Engineers Handbook."



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George H. Sanborn of Fellows Gear Shaper Co. answers a question on gear shaping in Detroit chapter gearing panel. At left are Ben F. Bregi of National Broach & Machine Co. and Charles R. Staub of Michigan Tool Co. E. D. Wiard (right) of Illinois Tool Works is moderator.

Gearing Problems" at the May 10 meeting of Detroit chapter.

The panel consisted of Charles R. Staub, chief engineer of the Michigan Tool Co.; George H. Sanborn, district

manager and chief field engineer of Fellows Gear Shaper Co., and Ben F. Bregi, executive engineer of the National Broach & Machine Co.

Using slides each speaker explained the fundamentals and the unusual in his field. Their subjects were: "Hobbing," Mr. Staub; "Gear Shaping," Mr. Sanborn, and "Gear Finishing," Mr. Bregi.

After the formal talks E. D. Wiard of Illinois Tool Works conducted a lively and informative question and answer period. Greatest controversy in the discussion revolved around tooth crowning to compensate for deflection as opposed to rigidity in design.

There with Bear," at their May 3 meeting.

Herman Deupree, assistant publicity director of the Indianapolis Speedway, served as commentator. In his introduction of Mr. Deupree, H. D. Hiatt, founder of the chapter, reminisced about earlier Memorial Day races at the Speedway.

The program followed dinner at the Athenaeum. E. W. Hilkenbach, chapter chairman, presided.

Leo M. Feeney drew the "Tool Engineers Handbook" given as door prize.

## Shafts, Bearings Limit Efficiency of Gearing

Kansas City, Mo.—Gearing is no better than its shafting and bearings, according to Ralph Snyder of Boston Gear Co., N. Quincy, Mass.

While speaking on "Gear Application" to 49 members and guests attending Kansas City chapter's May 2 meeting, Mr. Snyder pointed out that accurate fit of gearing to shafts is necessary for quiet operation and minimum wear. Adequate lubrication, accurate center distance, and provision for correct backlash are important for proper gear operation.

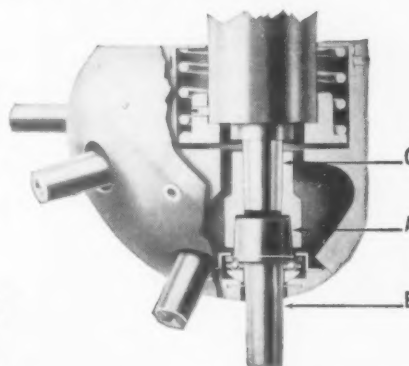
On stock gears, Mr. Snyder said, the bore is usually made to take the minimum size shafting for the horsepower that the gear will transmit. The gear is cut to provide backlash equal to 0.040 divided by the pitch of the gear. Gears with a 20 deg tooth form usually transmit about 20 percent more horsepower than a similar gear with a 14½ deg tooth form.

Mr. Snyder discussed some of these factors as applied to miter, helical, spiral, bevel and worm gear applications, concluding with a brief discussion of chain drive application. A brief question and answer period followed.

DETROIT, MICH.—Experts in three fields discussed phases of "Current

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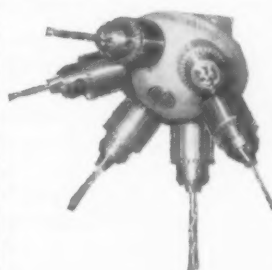
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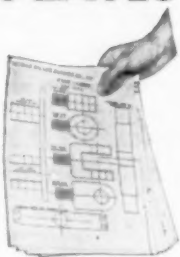
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**IIT Professor Describes  
New Perforating Tools**

Chicago, Ill.—Using relatively simple terminology, Professor Samuel E. Rusinoff of the Illinois Institute of Technology, gave Chicago members the fundamentals of dies and die design at the chapter's April 18 meeting.

An author on machine and machine tool subjects, Professor Rusinoff detailed blanking and forming dies, punch presses and accessories, emphasizing safety features. New types of perforating tools highlighted the professor's slide-illustrated talk. The session closed with a question and answer period. Robert Cowan, program chairman, introduced the speaker.

Professor Chatterton welcomed the 237 members attending the meeting in the faculty dining room of the University of Illinois at the Navy Pier, offering the facilities for future meetings.

After introducing his committee chairmen, Dale Long, chapter chairman, appealed for volunteers to serve on these committees.

Marshall Blu, host chairman for the 1952 Society convention and exposition, reported on his committee's progress.



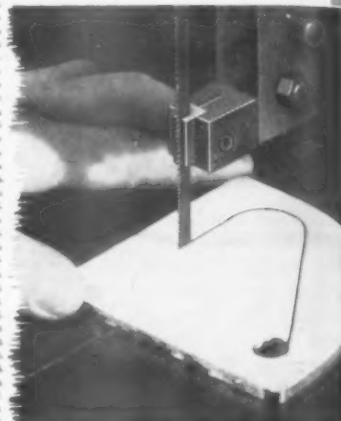
Prof. Samuel Rusinoff of the Illinois Institute of Technology listens to a question from a Chicago member in discussion that followed the professor's lecture on dies.

BALTIMORE, Md.—Dies, to turn out a single item, or thousands, as well as quantities in between, were all discussed by H. W. Van Dyke, plant metallurgist for the Doehler Die Casting Div., Doehler-Jarvis Corp., at Baltimore chapter's May 2 meeting in the Engineers Club.

Supplemented by slides and a film, Mr. Van Dyke's lecture pointed up the strides made in die casting over the past two decades. It drove home to his audience the tool engineer's importance in the success of this industry.

Prior to the technical talk, Paul Holland, Baltimore civilian defense direct-

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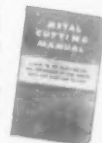


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INQUIRIES PROMPTLY ANSWERED

or, outlined progress and anticipated developments in overall preparedness against possible atomic attack.

William Schukraft, chapter chairman, presided and introduced the speakers and six new members.

## Optical Projection Talk Draws Inspection Men

Hartford, Conn.—A program on "Inspection by Optical Projection" brought large contingents of local industrial inspection staffs to Hartford chapter's May 7 meeting.

Willis DeBoer, vice-president of the Engineers Specialties Div. of Universal Engraving and Colorplate Co., Buffalo, N.Y., gave his audience unbiased explanations of the newest comparator and projection equipment.

His slides showed a variety of gaging fixtures. Their design, cost and application formed the basis of a discussion at the conclusion of the lecture.

During the dinner preceding the technical session Jean Colbert, popular Connecticut radio personality, talked informally about "Personalities and Events."

**R**OCHESTER, N.Y.—W. T. Nystrom of Brown & Sharpe Mfg. Co. explained "Modern Inspection Methods" to Rochester members attending the chapter's April 2 meeting at the Rochester Institute of Technology.

With slides and motion pictures Mr. Nystrom demonstrated electronic gaging devices for easy, fast and accurate external measurements.

In answer to questions from the floor, he compared the merits of the various gages.

James O. Horne, chairman, welcomed the group and outlined plans for an active year of technical meetings tying in with the defense program. Charles DeMartin, first vice-chairman, introduced Mr. Nystrom.

## Moly Steels Do Job Of Scarce Tungstens

Pittsburgh, Pa.—Critical shortages of tungsten and cobalt will force engineers to find substitutes for high speed steels such as 18-4-1. But no such scarcity of molybdenum is expected, provided additional mining equipment is available.

Properly heat treated, the improved moly steels are tougher than tungsten types, throughout the hardness range. The M-1 type is actually easier to grind than 18-4-1, and difficulties in grinding M-2 and 6-6-2 have been overcome.

These were among opinions expressed by a panel of 10 experts in answer to questions from Pittsburgh members participating in the chapter's Tool Steel Night, May 4, at the Sheraton Hotel.

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by using insert of proper Kennametal grade

### SAVE GRINDING WHEELS

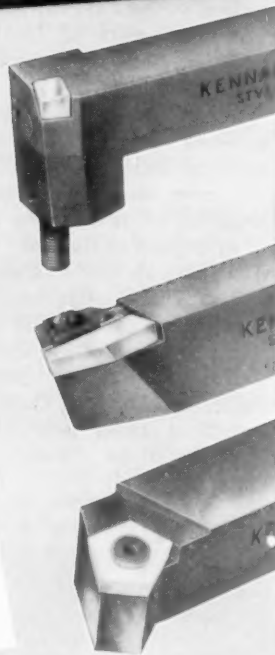
Grinding is simpler—less frequently required.  
No steel to grind

### SAVE CARBIDE

Mechanical-holding prevents brazing strains  
—insures best service from Kennametal

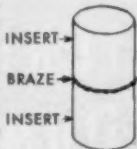
### SAVE "CRITICALS"

The mechanically-held technique enables you  
to get the best possible service from all  
tooling elements, thereby conserving mate-  
rials, machine-time, and man-hours



### HOW TO S-T-R-E-T-C-H KENNAMATIC INSERTS

When Kennametal inserts have been reground many times and have become too short for effective clamping, simply braze two "used" pieces end to end as shown. This permits proper clamping . . . and because Kennametal inserts are uniformly sound from top to bottom you get much more work from each insert.



The ruggedness, strain-free assembly, and convenience of mechanically-held Kennametal tools enable them to do many jobs that brazed tools cannot do . . . or to do them faster at less cost.

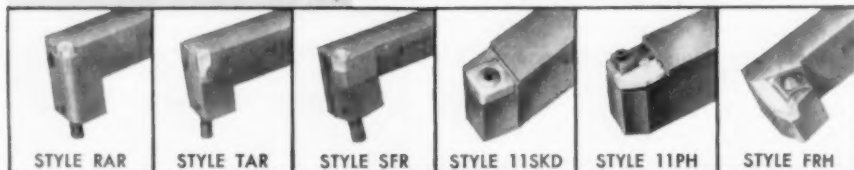
Standard Kennametal tools will handle the majority of these jobs . . . and the basic principles of their design are adaptable to a wide variety of special purpose clamped tools which can be made in your own shop. To assist you we have published a "Clamped Tool Design Manual." Write for a free copy.

Our nearest field engineer can help you use clamped tools most effectively. He represents our organization which pioneered the mechanically-held principle . . . offers you the greatest accumulation of tool-and-time-saving "know-how" available through one source.



**KENNAMETAL Inc., Latrobe, Pa.**

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES  
AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-80

Members of the panel were: John A. Nelson, vice-president of metallurgy and research, Braeburn Alloy Steel Corp.; Edward E. Hall, chief metallurgist, Universal Cyclops Steel Co.; A. D. Beeken, sales manager, Vulcan Crucible Steel Co.; George A. Roberts, chief metallurgist, Vanadium Alloys Steel Co.; S. G. Fletcher, chief metallurgist, Latrobe Electric Steel Co.

Martin Dempsey, metallurgical engineer, Crucible Steel Co. of America; L. V. Klaybor, associate director of research, and LeRoy Gippert, service engineer, tool and die steels, Allegheny Ludlum Steel Corp.; L. C. Grimshaw, manager of steel research, Firth Sterling Steel & Carbide Corp., and H. L. Harper, staff engineer, Aluminum Co. of America. A former chapter chairman, Mr. Harper served as moderator.

The speakers handed out direct answers in a lively session touching on all phases of tool steels.

A pre-meeting dinner attendance of 80 increased to 115 for the technical program. W. J. Bickmore presided and conducted a business meeting.

**SAN FRANCISCO, CALIF.**—In addition to helping users avoid improper applications of tool steels, the manufacturers of these materials try to correct their own errors, George M. Huck, manager of tool and alloy steels for Bethlehem Pacific Coast Steel Co., told 112 Golden Gate members and their guests.

Mr. Huck spoke to a chapter dinner meeting, May 16, at the Chukker Restaurant, San Mateo.

The speaker showed slides to illustrate his discussion of the selection and proper handling of tool steels. A color film, "Steel Builds the West," climaxed Mr. Huck's lecture.

Steel makers are constantly working to find the best material for the job, George M. Huck of Bethlehem Pacific Coast Steel Co. tells Golden Gate engineers.



# ELGIN ANNOUNCES

A COMPLETELY NEW,  
FASTER CUTTING DIAMOND  
ABRASIVE COMPOUND  
SPECIALLY DESIGNED FOR  
FINISHING CARBIDE



WIRE DRAWING DIES



HEADING DIES

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INDUSTRIAL PRODUCTS DIVISION  
ELGIN NATIONAL WATCH CO.  
ELGIN, ILLINOIS

INDICATE A-7-81-1

## Approaches Die Design From Economic Angle

Dover, N. H.—L. K. Parker of General Electric Co., Lynn, Mass., brought "A Practical Approach to Die Design" to 70 members and guests attending the May 8 dinner meeting of Granite State chapter at the American House.

In comparing types of die design and presses, Mr. Parker stressed the economic aspect. Throughout his lecture and functions of dies and presses. Sample strips of parts were displayed to show feed methods and blanking procedures.

At the close of Mr. Parker's talk the members entered into a general discussion and question period. James D. Wilson, program chairman, introduced Mr. Parker.

Charles E. Nystedt, chapter chairman, drew the complimentary dinner ticket.

TWO REPRESENTATIVES of Eutectic Welding Corp. presented the technical session at the April 10 meeting. John H. Poulson and Bruce Duchanes briefed the gathering on recent developments in the field of low melting, nonfusion, and welding materials.

Chairman Nystedt conducted a business meeting and introduced the speaker. Richard Wiley was awarded a complimentary dinner.



Pointing to a multi-slide part, L. K. Parker of General Electric Co. compares presses and types of die design for a Granite State audience.

## Bikini Spectator Debunks Exaggerated Bomb Effects

Worcester, Mass. — Fallacies surrounding the radioactivity, flash wave and other effects of atomic bomb blasts were dispelled by Dr. Philip W. Swain, editor of *Power and Operating Engineer*, speaking at Worcester chapter's May 1 meeting. Dr. Swain addressed

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▼ **STUART'S THREDKUT 99 MORE THAN DOUBLES TOOL LIFE PER GRIND.** In threading type 310 stainless male pipe union sections on large automatics, a Milwaukee plant was getting 136 pieces per tool grind. A change to Stuart's ThredKut 99 increased this to 310 pieces per grind—and the cost was 3c less per gallon for oil.

▼ **FORM TOOL LIFE INCREASED 36% WITH STUART'S SPEEDKUT B—**on 6 spindle automatics forming and threading cut-off cap screws of SAE 1060, 10-17 Rockwell C.

▼ **4 TO 1 LESS MACHINING DOWNTIME WITH SPEEDKUT B.** After changing to this Stuart product on an automatic turning out worm gear blanks, the customer reports, ". . . machine now made available to more production within its capacity."

ARE YOU really getting the capacity that was built into your automatic screw machines? In shop after shop, Stuart oils correctly applied have upped production substantially and, as a by-product, have usually improved quality and increased tool life.

It is worth finding out what a Stuart Representative can accomplish for you. Ask to have him call and SEND FOR EDUCATIONAL LITERATURE on cutting fluids for screw machines.

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INDICATE A-7-81-2

125 members and guests, including civilian defense leaders.

As a trade press representative at the Bikini bomb bursts, Dr. Swain witnessed both the air and the underwater explosions.

In describing these tests, he touched on the atom bomb's physical effects—temperatures, pressures, velocities, radiant heat and radioactivity—in the engineer's language of mathematics.

A documentary color-sound film depicting the Bikini tests climaxed Dr. Swain's presentation.

E. Roland Ljungquist, first vice-chairman, introduced the speaker.



### Vice-President Inducts Grand River Valley Officers

L. B. Bellamy, first vice-president, swears in 1951 officers at Galt, Ont. From left: Harry Sehl, chairman; William Copp, and S. S. Pritchard, vice-chairmen; David McCready, treasurer, and P. C. Barber, secretary. John Ward, second vice-chairman, was not present.

## Take a Tip FROM US...



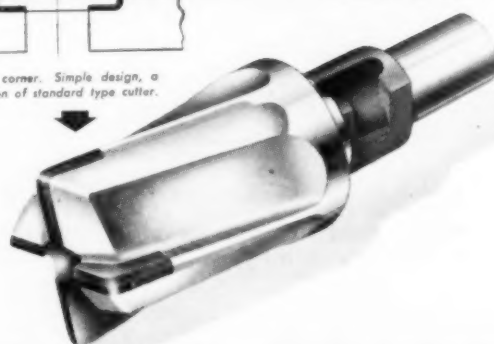
A common application in counterboring—chamfers and faces.



Radius corner. Simple design, a variation of standard type cutter.



Used in machining aluminum alloy. Finishes five surfaces.



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DETROIT 20, MICHIGAN

INDICATE A-7-82

### Coming Meetings

CHICAGO—March 17-21, 1952. The Engineers Industrial Exposition.

DETROIT—August 11. Golf party, lunch and dinner. Glen Oaks Country Club.

EVANSVILLE—July 9. Past Chairman Night and Annual Stag Picnic. Silver picnic grounds.

### Obituaries

#### Jacob Sokolov

Jacob Sokolov, 68, chief engineer of the Special Machine Div., Paramount Engineering Co., Detroit, died May 10 of a heart attack following a ten day illness.

Formerly associated with Chrysler Corp. and Packard Motor Car Co., Mr. Sokolov had been employed by Paramount for the past eight years.

The Detroit chapter member was born in Poltava, Russia, and came to the U.S. as a young man.

#### William W. Cady

William W. Cady, senior partner of W. W. Cady & Son, Philadelphia manufacturers' representatives, passed away April 20 in his 56th year.

A former secretary of Philadelphia chapter, Mr. Cady had been associated with abrasive manufacturers as service representative before establishing his own company.

#### John H. McDonald

John H. McDonald, 50, general foreman of the machine shop at LaPlant Choate Mfg. Co., Inc., Cedar Rapids, Iowa, passed away May 11, following a brief illness.

Mr. McDonald was a charter member of Cedar Rapids chapter. He was also member of the LaPlant Choate Management Club, in addition to civic and fraternal organizations. He was born in Leavenworth, Kans.

# News in Metalworking . . .

## ALUMINUM OUTPUT UP

Production of primary aluminum in this country advanced five percent during the first quarter of 1951 as over the total for the last quarter of 1950, according to Donald M. White, secretary of The Aluminum Association. Figures showed the 1951 quarter to be 401,431,462 pounds compared with 382,176,940 pounds, and represented a rise of about 25 percent over the same period last year. Nevertheless, Mr. White says, the combined military and civilian demand still is much greater than the available supply.

Sheet and plate shipped by the Association's member companies rose 18 percent over a year ago, though the total of 306,149,995 pounds shipped as of March represented a drop of about one percent of the last quarter of 1950.

## SELLS SCALE BUSINESS

Yale & Towne Manufacturing Co. has sold its Industrial scale business to Deteco Scales, Inc., effective June 1, according to Elmer F. Twyman, vice-president in charge of the Philadelphia Division. The transaction involved scale patents, equipment, parts and inventory, but none of the Yale trade marks except "Kron".

## NORTON SCHEDULES EXPANSION

A \$6,000,000 expansion plan will increase Norton Company's capacity by providing a new six and a half acre plant in the Greendale section of Worcester, Mass., for the manufacture of grinding machines.

The scheduled plant, which will be started in July with anticipated completion next March, is designed to be one of the largest single units for grinding machine manufacture in the world. It is expected to enlarge the company's machine tool manufacture by 50 to 60 percent.

## RELIANCE REPORTS EARNINGS

In a recent letter to its shareholders, The Reliance Electric & Engineering Co. reported net earnings, subject to final audit, of \$904,363, or \$2.16 per common share, for its fiscal half year ended April 30. This compares with net earnings for the first six months of the previous fiscal year of \$494,731 on net sales of \$7,413,911.

The \$23,500.00 backlog with which Reliance entered its third quarter is the largest in the company's history, according to J. W. Corey, company president.

## ANNUAL SCHOLARSHIPS AWARDED

Five girls and five boys have been named to receive \$500 scholarship each from the Allis-Chalmers Manufacturing Company. The scholarships, which are part of an annual award program started last year are presented to seniors in high school who are sons or daughters of Allis Chalmers employees and who meet qualifications set up by the scholarship committee. Winners may attend any accredited college, and the money may be applied to any expenses connected with their education.

Though the scholarship is for only one year, it may be renewed each year if the student satisfies the committee's requirements.

## SKILSAW CONTROLS LOUD-WENDEL

Controlling interest in Loud-Wendel, Inc. has been purchased by Skilsaw, Inc., manufacturers of portable power tools. In acquiring control of Loud-Wendel, Skilsaw is now assured of a constant source of high quality saw blades. Physical assets of the Middlebury company valued at \$400,000, include a modern plant, \$150,000 in recent plant machinery, and a large inventory.

## ELMES CELEBRATES CENTENNIAL

Expansion from the small building at the left to the rambling giant at the right represents the growth of the Elmes engineering organization—now the Elmes Engineering Division of American Steel Foundries—which this year celebrates its 100th anniversary.

The original business, founded by Carleton D. Elmes in Bath, Maine, was devoted to job-work machining, principally for the marine industry. In 1861 the firm was moved to Chicago, and when the elder Elmes died, the business was conducted under the name of his son, The Charles F. Elmes Engineering Works, as it was then called, was purchased in 1943 by American Steel Foundries and became known by its present name. Six years later it was moved to its present home in Cincinnati.

Today, under the leadership of Charles F. Elmes, great grandson of the founder, the organization manufactures a complete line of hydraulic presses and equipment.



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INDICATE A-7-84

## CARBOLLOY BECOMES G.E. DEPARTMENT

Effective June 30, Carboloy Company will become Carboloy Department of General Electric Company. Prior to the merger, Carboloy has been a wholly-owned affiliate. Management, offices and personnel will remain as in the past; K. R. Beardslee, who has been president of the organization, will continue as general manager of the G. E. department.

In a statement, Mr. Beardslee said industry generally is entering a new phase of technical history with trends toward the creation of many kinds of new man-made metals—not replacing the natural ones and their alloys, but permitting the creation of things we have not had and could not do before. Mr. Beardslee foresees the metallic carbides, permanent magnets and radiation resistant Hevimet only as a foreshadowing of those to come. Already in the laboratory stages are promising developments which may have wide potential applications.

The corporate shift, he revealed, will enlarge the available scientific and technical help, thus speed development, and is in line with a vast potential broadening of experimentation, capacity and products, as well as materially facilitating expansion of overall Carboloy activities.

## GRAY IRON CONTEST OPEN

Gray Iron Founders' Society, has announced the opening of its 1951 Redesign Contest. The award program gives recognition to those who submit the best examples of the redesign of component for production in gray iron.

With a first award of \$200, prizes totaling \$350 will be given this year to the three top winners.

The contest is open to all engineers, designers or other interested persons, whether or not they are employees of member companies.

## READY TOOL OPENS DEPARTMENT

Shortages of the vital materials and parts has prompted the opening of a repair service department by the Ready Tool Co., makers of anti-friction bearing centers. Anticipated field of service includes the many companies who find themselves unable to qualify for defense orders requiring accurate tolerances and strict adherence to specifications, since centers being used on the machines are old, worn and in need of reconditioning.

## STEEL FOUNDERS SPONSOR CONTEST

The 1951 national safety contest sponsored by Steel Founders' Society of America, is expected to result in continuing improvement in steel foundry safety practices.

The national competition, open to more than 150 member steel foundries is being conducted during the months of June, July and August. This quarterly period according to reports, is a period during which accident frequencies are high.

Rules of the American Standards Association will be used to determine lost time injury rates for the participating foundries, and awards will be based on statistical results of monthly reports filed with the Society.

A permanent plaque will be awarded to the winner in each of four size groups, and a certificate of achievement will be presented to each foundry having a lost-time accident frequency rate of 10.0 or less per 1,000,000 man hours of exposure for the contest period.

## COLTON PLANT ESTABLISHED

The Arthur Colton Co., Division of Snyder Tool & Engineering Co., has established a second plant in Paducah, Ky., to produce punches and dies for the pharmaceutical trade.

Formerly a part of the Ace Manufacturing Co., which has ceased production activities, the plant facilities are known as the Paducah Plant of the Arthur Colton Co. Modern, high production equipment for making punches and dies to Colton specifications already have been installed, and the operating staff is being substantially increased, according to Howard N. Maynard, president.

## SIMONDS OPENS BRANCHES

Branch office and warehouse facilities have been opened in both Chicago and Detroit by Simonds Abrasive Co. grinding wheel and abrasive manufacturers.

The Chicago warehouse, occupied jointly with the parent company, Simonds Saw & Steel Co., is located at 3323 W. Addison St. The Detroit warehouse is situated at 17155 Conant

## GRINDING MOVIE AVAILABLE

A color motion picture, "Grits That Grind," has been made available from the Norton Company.

Showing step by step manufacturing processes from mining bauxite in Arkansas to the finished product—the 10 mm. film requires 30-minutes. This is the nineteenth in the series of films available from Norton, Worcester, Mass.

# THE TOOL ENGINEER'S

# Service Bureau

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
110	ADAMAS CARBIDE CORP.		Illustrated booklet "Brass and Bore" discusses brazing your own tools, emphasizing economy in time and money.
120	ALLEGHENY LUGLUM STEEL CORP.		"Cutting Tool Materials" discusses subject fully giving recommendations for proper material for specific uses.
22	AMERICAN BROACH & MACHINE CO.	300	Circular on company's broaching equipment and the problems it meets.
17	AMPCO METAL, INC.		Literature gives descriptions and general applications of Aspec metal.
20	E. E. ANDERSON OIL CO.		Twenty-page book "Lapal—the All-Chemical Metalworking Solution" presents information of this cutting fluid.
143	DEHR-MANNING		Belt finishing brochure data and recent ideas on cutting finishing costs.
145	THE BELLOWES CO.		Bulletin shows wiring diagrams, technical data, case histories on company's "Controlled Air Power" device.
152	BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.		Informative booklet discusses cutting costs and speeding production with company's air cylinder.
149	CHARLES H. BESLEY & CO.		Tapping manual contains data on tap selection and application and tapping procedures. Lists tap fit and drill sizes.
8	THE CINCINNATI SHAPER CO.	DN-1	Bulletin presents information on company's automatic contour duplicating machine stressing its wide applications.
138-2	THE CLEVELAND TAPPING MACHINE CO.	T-3	"Production Tapping Guide T-3" covers tapping problems.
117	THE CUSHMAN CHUCK CO.	FO-3	Bulletin covers Cushman's recently introduced iron body air cylinders.
141	THE DOALL CO.		Catalog on tool grinding stress advantages and features of company's grinder line.
64	ENGIS EQUIPMENT CO.	T-751	Comprehensive catalog covers line of precision measuring devices.
107	HANNIFIN CORP.	310	Bulletin discusses company's plan for solving cylinder problems.
126	HAYNES STELLITE CO.		"Operating Information on Haynes Stellite 98-M-2 Cobalt-Chromium-Tungsten Alloy Turning and Boring Tools and Milling Cutters."
77	HOWE & FANT, INC.		Literature on Ligno-mide turners for drill presses.
135	THE LAPOINTE MACHINE TOOL CO.	DRV-5	Bulletin contains complete engineering data on Lapointe equipment.
24	LATROBE ELECTRIC STEEL CO.		Five brochures cover Latrobe's Designated Brand molybdenum high speed steels—Electrite Double-Six, Electrite Tanno, Electrite TNN, Electrite MV Series and Electrite HV-6.
144	METALS CARBIDES CORP.	50-C	Catalog treats line of tungsten carbide dies, stressing features, advantages and economy.
78-2	THE HENRY C. THOMPSON & SON CO.		Literature presents complete product data plus helpful suggestions on metal cutting.
9	MILLER MOTOR CO.	A-105	Bulletin emphasizing advantages of company's air cylinders also "I.I.C. Pneumatic Standards for Industrial Equipment."
74	MORTON MACHINE WORKS		Illustrated 72-page catalog shows complete line of fixture clamps and components; includes full size templates.
137	NATIONAL BROACH AND MACHINE CO.		Descriptive literature covers Red Ring gear shaving and automatic loading equipment.
19	NORTON CO.	1787, 1488, 166, 187	Catalogs describe features of company's 10" semi-automatic, 6" semi-automatic, 10" plain and 6" plain machines respectively.
146-2	OAKITE PRODUCTS, INC.		Forty-four-page illustrated booklet, "Some Good Things to Know About Metal Cleaning" answers questions on this problem.
78-1	ORTMAN-MILLER MACHINE CO., INC.		Complete set of templates showing all cylinders and mounting brackets.
73	PHYSICISTS RESEARCH CO.		Brochure covers instrument line stressing cost cutting in production.
148-5	PYOTT FOUNDRY & MACHINE CO.	80	Catalog describes company's cushion pulleys.
92	THE STANDARD ELECTRICAL TOOL CO.	44	Catalog presents information on attachments converting shapers, boring mills, planers to grinders.
140-3	P. A. STURTEVANT CO.		"Sturtevant Torque Manual" contains valuable data for the manufacturer, designer and production man.
13	SUNDSTRAND MACHINE TOOL CO.	709	Bulletin describes current developments in Sundstrand machine designs.
114-1	SWARTZ TOOL PRODUCTS CO., INC.	941	Catalog describes company's lock, covering advantages and features.
116-1	THE VAN NEEUEN CO.	34	Catalog and handbook contains 208 pages of data representing two years of research on measuring and gaging.

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

## Spindles

Catalog 58A covers two series of heavy duty precision motorized spindles with sealed-in lubrication and wheel holders to match; includes detailed engineering drawings and specifications of each style; installation diagrams and suggestions also described and pictured. **Pope Machinery Corp.**, 261 River St., Haverhill, Mass.

L-7-1

## Machining

Timely reprint M-1739, "The Application of Cutting Fluids to Machining Operations" treats general principles, applications on various equipment and operations; drawings and photographs illustrate different points. **The Cincinnati Milling Machine Co.**, Cincinnati.

L-7-2

## Tools, Tungsten, Carbide

Catalog in color shows company's line of solid tungsten carbide rotary files, reamers, end mills, boring bits, grinding tools, knurls and small chatterless counter sinks, and also introduces line of tungsten carbide drills. **The Atrax Co.**, Dept. C, Newington 11, Conn.

L-7-3

## Detergents, Solvents

Twenty-four page booklet reports on classifications of cleaning in which solvent detergents are being successfully used on carbon, grease, dirt, paint; presents specific applications in various plants and operations listing problem, and composition used; photos illustrate. Explains various compounds, their advantages, manual, spray rinse, tank and machine cleaning methods of use. **Oakite Products Inc.**, 158 Thames St., New York 6.

L-7-4

## Steels, Aircraft

Sixty-eight-page booklet on aircraft steels includes condensed listing of essential features of the Military (MIL) Aeronautical Specifications; also includes digest of many Air Force-Navy (AN), Federal (QQ) and Aeronautical Material Specifications (AMS) pertaining to steel, plus nearest corresponding AISI analyses. **Joseph T. Ryerson & Son, Inc.**, Box 8000-A, Chicago 80.

L-7-5

## Fasteners, Cold Headed

Illustrated 34-page catalog 60 explains operation and material cost economies of cold headed fasteners; pictures variety of nails, rivets, screws and other specialties accompanied by descriptions and specifications; includes numerous reference tables as well. **John Hassall, Inc.**, Clay and Oakland Sts. Brooklyn 22.

L-7-6

## Feed Table

Bulletin T-80 describes completely the company's rotary work feed table; shows installation photographs and describes all parts of the equipment in detail; dimensional drawings and specification data also included; shows wiring diagrams and electrical hook-ups to combine the table with other pneumatic devices. **The Bellows Co.**, Akron 9, Ohio.

L-7-7

## Metal Stamping Dies

Forty-page booklet illustrates and describes Williams Universal Die System explaining elements of construction, component parts, engineering details; engineering drawings and instruction lists for various applications included. **Connecticut Tool & Engineering Co.**, 544 Iranistan Ave., Bridgeport 5, Conn.

L-7-8

## Contact Wheel

Illustrated with photos, drawings and graphs, folder presents advantages of "61" contact wheel designed for eliminating glazing belt and other problems. Prices included. **The Carborundum Co.**, Niagara Falls, N. Y.

L-7-9

## Polishing, Finishing

Folder presents information on company's line of accessories to be used with its diamond compound for lapping, polishing or fine finishing, including felt bobs and wheels, abrasive stones, brushes and lapping sticks; dimensional and price information listed as well as illustrative drawings. **Industrial Products Div., Elgin National Watch Co.**, Elgin, Ill.

L-7-10

## Lathes

Catalog T-101 covers company's tray-top engine, toolroom and gap lathes, giving specifications, descriptions of design and construction features and tables of available threads and feeds; fully illustrated. **Cincinnati Lathe and Tool Co.**, Cincinnati 9.

L-7-11

## Carbide Tooling

Widely illustrated, 73-page catalog 51 includes recommended grades of different materials and types of cutters; suggestions for cutting speeds on steels of different hardnesses; machining hints for steel, cast-iron and non-ferrous materials; tool wear analysis; descriptions of Kennametal compositions, with analysis of mechanical and physical properties, and characteristics of the newer heat-resistant "Kennamium"; how to get best results from products; illustrations of typical wear resistant applications. **Kennametal Inc.**, Latrobe, Pa.

L-7-12

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## Giddings & Lewis Introduces Huge Hydro Aircraft Skin Mill



A production tool on a grand scale that is not only capable of producing complete jet aircraft "skins" of lighter stronger construction than heretofore possible, but which may also revolutionize aircraft manufacture, was recently unveiled by the Giddings & Lewis Machine Tool Company, Fond du Lac, Wisconsin.

Aimed at adapting jet aircraft to the demands of near-sonic speeds, this machine—named the Hydro Aircraft Skin Mill—is a joint design by Giddings & Lewis, General Electric and Lockheed Aircraft Corporation engineers in accordance with basic Lockheed specifications. The latter corporation will pioneer its use in the manufacture of F-94 jet fighters in its "Hall of Giants" fabricating plant at Burbank, California.

As designed, the machine will completely mill self-reinforced aircraft skins from sheets of solid or rough-forged aluminum alloy. According to aircraft engineers, this revolutionary method of fabrication will permit use of thinner and lighter wings and small fuselages. Conventional wing design, with its welding or riveting of struts, louces and girders will be supplanted with integral ribbing, milled into the "skins", which in turn portends greater "pay load" in heavier armament,

additional instrumentation and increased fuel capacity.

Naturally, such an application calls for a tool of broad dimensions, as may be judged from the illustrations. Actually, the machine is 18 ft. high, 30 ft. wide and over 80 ft. long, and electric motors on the machine alone have a rating of 350 hp. Other rotating equipment supplying the machine is equivalent to 1400 hp.

The machine uses General Electric motors and controls throughout. A two-dimensional electronic tracer control, developed by G-E engineers, is used to guide longitudinal and lateral cutting motions simultaneously. Also incorporated is a vertical rise-and-fall cutting action designed to control variations in web thickness. Three milling heads—two of which may be used simultaneously—employ Onsrud Machine Works water-cooled units powered by 100 hp G-E induction motor parts. Feed range, operating in three dimensions with two motions, is infinite between  $\frac{3}{4}$  and 150 ipm.

Work area of the table, designed to carry a 150-ton work load, is 10 x 34 ft.; however, a catwalk over the table permits the operator to have full view of the work at all times. Furthermore, controls are so situated that, in addition to automatic functioning, he has

manual steering control for any direction in the plane of the table. The tracer contouring control also provides constant feed speed regardless of the outline of the work.

Among other features—and denoting meticulous regard for details—are the elimination of trailing hose and wire through use of a novel feed reel contained in an overhead housing that spans the table, and wide steel belts that, travelling with longitudinal table feed, protect the bed ways from chips and foreign matter.

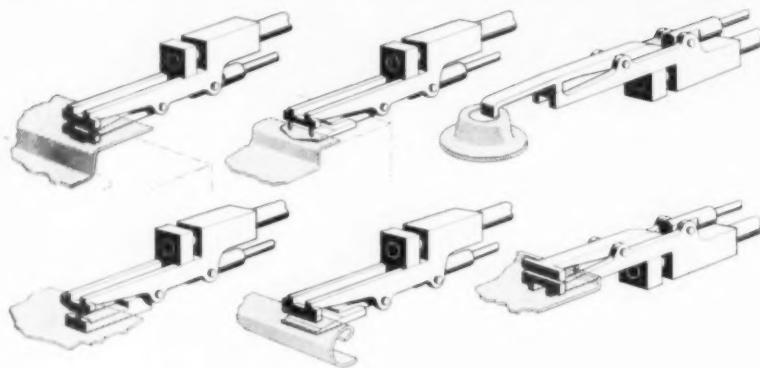
Such protection is practically a "must" in view of the fact that the cutters, running at surface speeds up to 10,000 fpm, produce chips at such a rate that in-built chip conveyors are necessary to carry the chips from the work. In this connection—and at first thought rather paradoxical—the chips produced may total 90 percent of the finished part; yet, such is the speed of operation that the milling from solid is said to effect marked economies over conventional methods of wing fabrication.

In view of specialized although by no means limited application, a detailed outline of specifications would serve no particular purpose in this "preview", using that term since the machine will not go into actual production until later in the summer. Nevertheless, it represents the near ultimate in tool engineering and promises to be a pace-maker in the production of better and safer fighter and civilian aircraft.

T-7-87



## Jaws for Pressed Metal Unloading

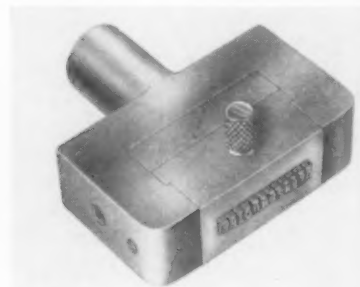


Sahlin Engineering Co., Birmingham, Mich., has developed six metal jaws for use with the Sahlin "Iron Hand", which accommodate various die and lip conditions encountered in the automatic unloading of stamping presses. The gripping members, in combination with the three models of the "Iron Hand", provides safe mechanical unloading as contrasted to the slower and dangerous manual unloading.

Shown in order, left to right upper row, are the vise-standard which grips parts with 2 in. clearing above the die; the chisel, whose blade scrapes parts off the die; and the hook, for parts where gripping edge is lacking. Bottom row, left to right, shows the pivot, which swivels the part to clear the die; the Neoprene-tipped, which protects finish; and the confined, which locks parts having a vertical plunge. **T-7-80**

## Press Type Holder

A press type holder which allows a press operator to remove and replace the type chase without placing his hands in a dangerous position, has been introduced by M. E. Cunningham Company, 169 E. Carson St., Pittsburgh 3, Pa. Designated the Model PH-50, this marking device includes a removable type chase and a shank with a yoke shaped outer frame. The shank, which remains in the press while type is being changed, can be made to any size for fitting individual press requirements. Attached to the shank is a replaceable ground tool steel base plate.



The type chase is made with a "T" head that fits in the machined offset inside the holder frame. To prevent injury from accidental activation of the press, a small knurled handle is set permanently in front of the chase. While removing the chase for making type changes, the press operator simply holds this knurled handle by two fingers, thereby keeping his hands free of the press. The type chase is reset in position by tightening a set screw on one side.

The slot in the type chase can be made for either straight line or curved line marking. Shouldered type is dropped into position through the back of the type chase. **T-7-80**

## A better Lathe from any angle.



By whatever standards you measure a lathe—bearings, capacity, gearing, apron, bed, power to spindle, accuracy—whatever is important to you, you will find it completely satisfied in a SHELDON lathe.

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SHELDON MACHINE CO., Inc., 4229 North Knox Ave., Chicago 41, Ill.

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## Single-Spindle Automatic

C. R. Bachmann Corp., 130 W. 42nd St., New York 18, N. Y., is U. S. Representative for the Traub single-spindle automatics. Built of simple and accessible units, thereby facilitating change of tools and cams for short runs, these machines are built in four sizes and take standard Brown & Sharpe collets in range 19/32 to 1-13/32 in. Because of the stock feeding arrangements, which includes magazine and hopper feeds, the machines may be used advantageously on 2nd operation work and long production runs.



The smallest machine—Model A-15—uses standard B & S No. 10 collets, has spindle speeds up to 6500 rpm, and is mainly used for mass production of small precision parts. Model A-20 uses No. 11 B & S collets, has spindle speed of 4000 rpm and is used to machine screw stock up to 13/16 in.

Model A-25 has maximum collet capacity of 1 in., spindle speed of 4000 rpm and is used for turning free-cutting, while Model A-36—the largest—has spindle speeds up to 2500 rpm. In addition to standard B & S collets, the two largest machines also use Traub-Index collets. The four models provide for precision turning in all of the size ranges stated. Complete information available from the representative.

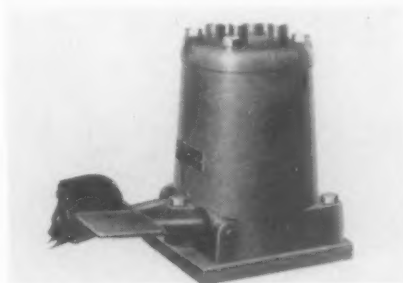
**T-7-891**

## Stroboscope Indicator

A low-cost, portable flashlight-type stroboscope for indicating synchronous speeds is announced by the Synchroscope Co., 57 William St., New York 5, N.Y. Measuring only 1½ x 5 in. and weighing less than 5 oz., the tool is said to be entirely accurate for production and laboratory testing of synchronous motors, timing devices, business machines and other equipment where speeds must be synchronized. **T-7-892**

## Foot-operated Air Valve

C. B. Hunt & Son, Inc., 2200 E. Pershing Ave., Salem, Ohio, announces



the foot-operated Quick-As-Wink air valve which permits air operated equipment to be controlled by foot pressure on a pedal. Consequently, the operator has both hands free to handle the work.

All operating parts are fully enclosed to exclude dirt, and protected within a sturdy cast iron housing. The valve is available in pipe sizes 3/8 to 1 in.; in 3-way, 4-way, neutral position and regular actions; and in single and two pedal designs for air to 150 psi and temperatures to 150 deg F. Fully described in company literature.

**T-7-893**

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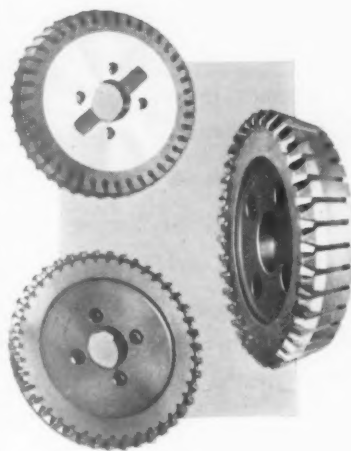
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AND  
PRODUCING  
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## Copying Equipment

Xerography, as the Haloid Co. of Rochester 3, N.Y., calls its copying

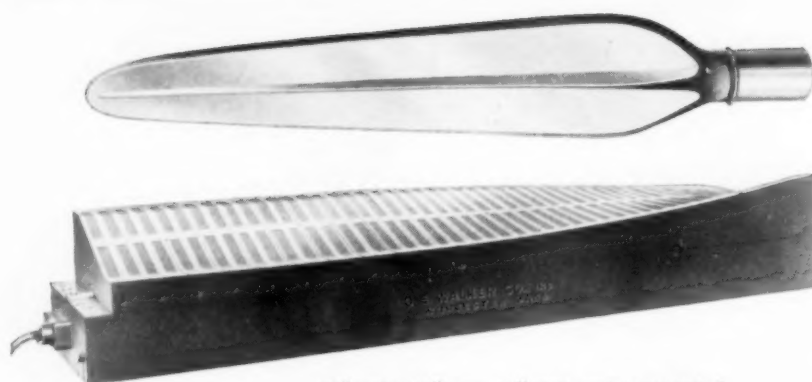


method, is a dry, electrical, direct-positive process for copying anything written, printed, or drawn in sizes up to 8 1/2 x 13 in. No negative is required, and as claimed by the manufacturer, engineering drawings or other sheets can be reproduced by direct contact in less than two minutes. The same types of copy can be reproduced on offset paper masters for limited or quantity production.

The equipment consists of a Xerox Camera, a copier, and a fuser, shown in that order from right to left. The entire "workings" of this interesting development are described in company literature, available on request.

**T-7-901**

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27" wide, 96" long, 14" high, weight 10,600 #

**WALKER** meets emergencies. For example, a Walker contribution to the propeller bottleneck in World War II and Korea is shown by this contour chuck which makes possible effectively machining propellers to minute tolerances of accuracy resulting in increased production and elimination of rejects.

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## Perforating Press

A 150-ton high-speed perforating press, designed to punch slots, rounds or ovals, either in straight rows or with alternating rows staggered, has been developed by E. W. Bliss Co., Canton, Ohio. The second of a series which is to include 250-ton and 400-ton models, the press is built to operate in a speed range from 100 to 200 spm with a variable speed drive and will handle sheets up to 54 in. wide.



The stagger motion, which is adjustable, is accomplished by feeding the sheet straight through and moving the die set from side to side. A counter attachment, set to stop the press automatically after a predetermined number of rows have been punched, is useful where bank spacings are required. A safety device stops the feed before the tail of the sheet reaches the punching line, leaving any desired edge margin.

The precision feeding mechanism, consisting of entry and exit feed rolls, is adjustable for different feed increments. A releasing mechanism, provided for the upper gripping rolls, releases both rolls simultaneously. The feed rolls can be slid clear for installation of die sets from front or back, and the die may also be inserted through the uprights. Press stroke is adjustable for different stock thickness.

**T-7-902**

## Oil Cooler

The Will Cool oil cooler, announced by the B. S. Williams Co., Inc., 6 North St., Mt. Vernon, N.Y., has been developed for use on machine tools to cool and control lubricating, hydraulic and cutting oils to a year-round predetermined temperature. The oils are not exposed to the atmosphere while being cooled.

Advantages claimed for the cooler are: increased capacity and uniform work pieces; uniform oil viscosity and longer tool life; less tool grinding and less adjusting time on machines; cooler work pieces to handle, and reduction of oil evaporation.

## Bench Lathe

A low-cost bench lathe that features double V-ways and a compound rest that swivels 360 deg is announced by Hamilton Products, Inc., Dept. L-7,



12416 Euclid Ave., Cleveland 6, Ohio. It is equipped to turn small shafts in addition to face plate work, and operates with a 1/4 hp 1750 rpm motor.

Swing over ways is 6 in., and bed length is 26 in. with a cutting range 18 1/2 in. Accessories include one hand feed or hand shaper attachment, two bell and two 60 deg centers, two driving dogs, power feed belts, a 4 in. face plate and a tool bit. The lathe, said to be precision built, may also be used for taper turning. **T-7-912**

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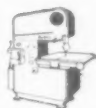
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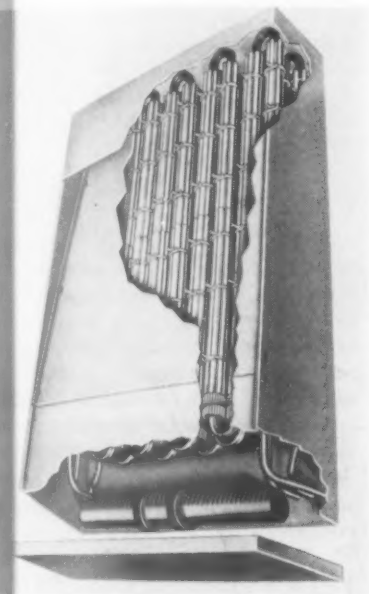


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The cooler is designed so that the inside and cooling surface can be inspected and cleaned without disconnecting refrigerant or oil lines. Even the inspection cover is removable without disconnecting these lines, and accumulation of fine metal particles is restricted to a non-cooling surface where they can be seen and removed.

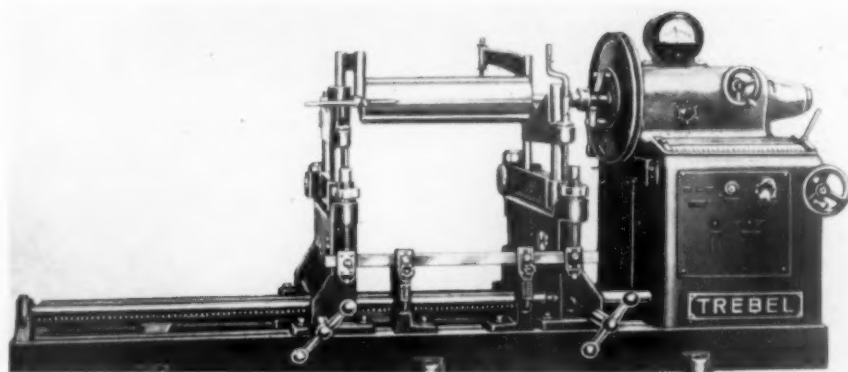
In operation, the oil is confined to the cooling surface in a film and flows by gravity over the surface and back to the machine tool's tank. Refrigerant liquid does not feed to the cooler during the off-cycle.

The cooler is designed to cool all machine tool oils within their range of viscosities so that different oils may be selected if desired without affecting operation. The size range is from 1 1/2 to 7 1/2 tons.

**T-7-911**

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## Balancing Machine from Germany



Trebel Works, of Western Germany now offer a complete line of dynamic balancing machines with electro-mechanical measuring apparatus. In the machines, the reaction of the bearing rolls is transmitted elastically by means of a novel system of levers to supporting springs.

Any unbalance of the rotating piece creates oscillations of resonance in the bearing rods which, in turn, generate an electric current in a solenoid. A measuring beam connects the bearings with measuring blocks placed beneath predetermined planes of composition of the test piece. The measuring springs then introduce counter-oscillations into the measuring beams.

Special dynamic balancing machines for cranks, propellers, shafts, as well as static balancers are also available. Complete particulars may be had from the importer, Kurt Orban Co., 21 West 42nd Street, New York 6, N. Y. T-7

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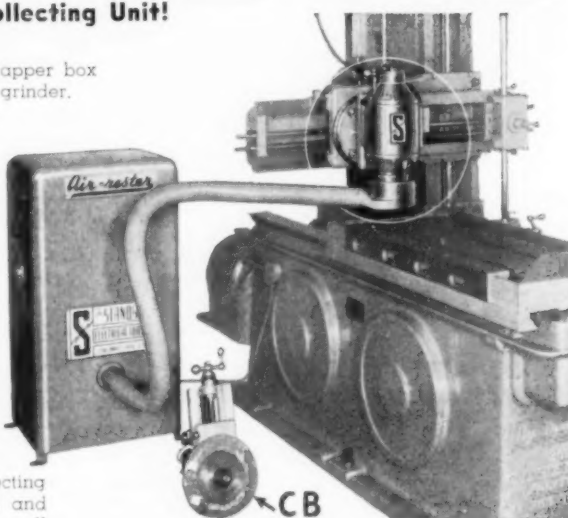
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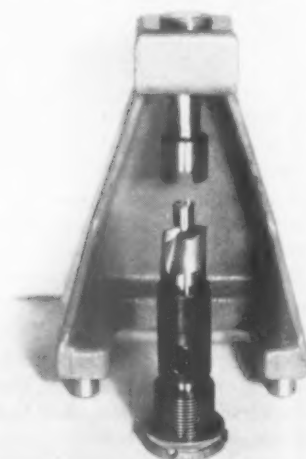
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## Pre-Setting Gages

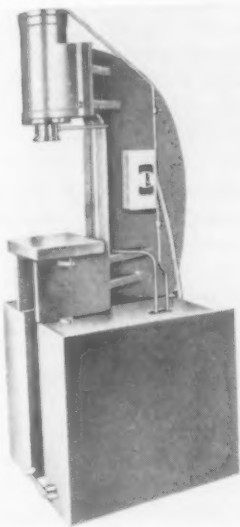
Scully-Jones & Co., 1915 So. La Salle St., Chicago 8, Ill., announces new lines of gages—a flush pin gage and a height gage, both used for pre-setting drills, taps, reamers, counterbores, countersinks and other cutting tools which have been inserted in adjustable adapters before being placed in machine spindles. These gages are designed to materially reduce set-up time on multiple-spindle and transfer machines.



The flush pin gage is made of tool steel with three hardened jig bushings and pin. The five sizes will gage distances up to 14 inches and may also be used for gaging parts. The height gage is hardened and ground and is equipped with a locking nut which enables the set-up to be adjusted and locked on the part. The five sizes gage distances up to 14 inches. T-7

## 20-Ton Hydraulic Press

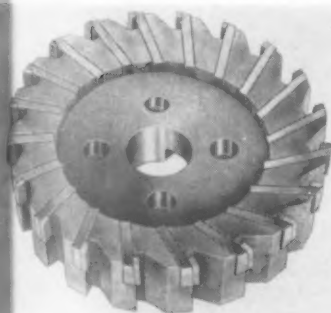
Ross & Company, 1401 East 57th St., Chicago 37, Ill., announces production of a motor-driven hydraulic press for assembling, broaching, forming, riveting and general forcing operations. Double-acting, this press has an 8 in. throat and 12 in. ram travel. Clearance under the retracted ram is 16 in., and ram speed is 60 ipm on power stroke, 90 ipm on return stroke.



The ram is controlled by a foot pedal and actuated by a vane-type pump set to operate at 1200 psi. The entire press is of steel welded construction except for the cylinder, which is a Meehanite casting. The power unit is contained in the base to provide a compact, portable unit occupying 28 x 34 in. floor space.

T-7-931

## Insert Face Mill



Added to the line of cutting tools by the Nelco Tool Co., Manchester, Conn., is a removable insert face mill featuring fewer parts, a heavier and more rigid body, a positive locking action and carbide-tipped blades. The cutter is recommended by the maker for milling cast iron, steel, aluminum, brass and bronze and is said to produce an exceptionally fine finish at high table feeds.

T-7-932

## Abrasive Contact Wheel

A novel type of contact wheel for abrasive belt applications on backstand



idler grinding, and broadly applicable in the metal working field, has been announced by the Carborundum Co., Niagara Falls, N.Y. This serrated contact wheel is said to permit an operator to practically double production in those operations where, normally, glazing would occur with abrasive belts running on wheels of previous design.

This "61" wheel is a specially-serrated rubber wheel that causes a controlled breakdown in the bond of the abrasive belt; as a result, glazing is reduced to an extent that, as claimed, belt life may be doubled. T-7-933

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## Abstracts of Foreign Technical Literature

By M. Kronenberg

**Great Britain:** Armament establishments, inspected by the British Press, are described in an article in *Engineering* of April 27. Two machine shops, each of 600 by 300 ft size and a large tool department make up the Royal Ordnance Factory, Llanishey, Cardiff, which is engaged in the production of twenty pound guns for the Centurion tank.

At the end of the World War II it was decided to keep the factory in commission and to prevent the disbandment of skilled personnel, large trained within the plant, by undertaking production of civilian goods. The factory is now again engaged in the work for which it was laid down originally.

No new machines have been installed but production expanded by use of much higher cutting speeds, modifications of machine tools etc. In some cases the machine bed is one made at the headstock another. Broaching has become instrumental in removing some of the factors limiting production and is being increasingly used not only in finishing the guns but also for rifling them.

It is of course not permissible to describe the production of guns in detail which involves some 60 different operations on the gun barrel, 70 operations on the breech ring and 58 operations on the block. Therefore, the article covers the work mostly in broad terms, although some operations are discussed in detail.

At the annual general meeting of the Institute of Metals, held recently in London, a day was devoted to a symposium on cold working of nonferrous metals. Considerable discussion resulted as reported in *Metallurgia* of April.

The papers covered "Fundamental Aspects of Cold Working", "Lubrication for Cold Working of Nonferrous Metals", "Cold Rolling", "Wire Drawing and Deep Drawing" and "Processing of Nonferrous Metals". The last two papers are of particular interest to tool engineers because they touch upon topics such as the use of sintered carbide tools and high-speed steel tools. The material from which the press tool may be made is discussed at length and the advantages of sintered carbide tools are pointed out.

Carbon and high-speed steel tools

The Tool Engineer

have been discussed also; the latter ones are satisfactory in cases where the tungsten carbons were thoroughly dispersed. Second to sintered carbide tools, which are vastly more expensive, the use of nitrided high carbon—high chromium steel often offers an effective solution in the case of tool troubles.

Production engineers and machine designers often are confronted with the problem of feeding nuts to various machines or to a particular location for assembly to other components. Due to the large quantities of pieces involved, it often pays to design hoppers for handling such jobs, as pointed out by J. R. Paquin in the British edition of *Machinery* of May. He describes the design of various types of hoppers.

The hopper feed must be carefully designed and built, because flimsy mechanisms cause difficulties which many companies have experienced.

External finish and accuracy have assumed a considerably greater significance since the advent of jet engines in aircraft. An accuracy of  $\pm 0.002$  in. for a gage length of 2 in. cannot easily be obtained in what is mainly a sheet metal structure and new techniques have developed in recent years as discussed in the British edition of *Machinery* of May 3. In the "Fairey Envelope" tooling system the conventional tooling procedure is reversed and the external form of assembly is controlled by holding the skin to contain while the internal structure is being built up on it.

Coordination of tooling, use of standardized parts, and marking out equipment are discussed in the article supplemented with numerous diagrams and illustrations.

**Germany:** Toolroom machines, tools and instruments are discussed in *Werkstatt Technik und Maschinenbau* of April in connection with the industrial exhibition recently held at Hannover. The first time this show took place, in 1947, only five halls were required covering about 170,000 sq ft while this year 20 halls covering 1,500,000 sq ft were needed for the exhibits of more than 2500 companies.

O. Kienle and H. Maeckelt, in a report on toolroom machines, discuss a ram type milling machine with attachments for drilling and boring operations at high speeds from 1900 to 6000 rpm. The machine, equipped with a table that can be tilted in three directions, also permits slotting at 24 to 235 strokes per min and threadmilling.

An optical profile grinding machine for grinding of flat workpieces such as templates yet permitting grinding also of more complex and bulky workpieces such as cams was exhibited. The table can be swivelled through an angle of  $\pm 45$  deg, the grinding wheel through

an angle of  $\pm 150$  deg. Magnification can be varied between 17 diam and 40 diam. The accuracy is  $\pm 0.0001$  in.

A hydraulically operated duplex copying milling machine, using the principle of "mirror image", was likewise shown. Other exhibits included a tool grinder with a microscope, used for controlling the radius of the tool nose when finish grinding, lathe tools with diamond wheels and a special grinding machine for producing uniform chip breakers on cutting tools. Width and depth of the chip breaker can be adjusted.

Among the great number of precision instruments and tools the following will be of interest: An attachment for measuring crankshaft bearing diameters during grinding, an instrument for measuring the pitch of internal gears, a microscope permitting readings of surface roughness of less than 0.000040 in., a tool dynamometer equipped with a recording attachment for measuring the main (tangential) cutting force and milling cutters with two rows of teeth set at different depth.

Tools for deep hole drilling, and hydraulically or mechanically operated expanding mandrels for chucking hollow workpieces likewise were on exhibit.

What the tool engineer expects the machine tool manufacturer to do to improve performance of machine tools is discussed by E. Broedner in an article, published in *Werkstatt Technik und Maschinenbau* of October, 1950. After indicating that dynamic rigidity of machine tools is still in its infancy but increasingly required in order to reduce and eliminate vibration which is detrimental to carbide tools, the author submits that threads are cut on only one out of ten lathes in the average shop. He concludes that thread cutting equipment is not required on many lathes and that the price of such machines could therefore be reduced when the lead screw and the complete feed box are made optional rather than standard equipment.

His survey showed that 90 percent of all turning operations involves workpieces not longer than about 30 in., although many tool engineers often try to buy the longer machine in order to be on the safe side. The author reports furthermore that about one third of all machine tool troubles in German plants were due to failure in the electric equipment and another third was caused by faulty pumps, brakes and clutches. He suggests therefore that more attention be given to these items when designing machine tools and requests that improvements in cooling systems, chip removal and easy accessibility to internal parts be taken into consideration.

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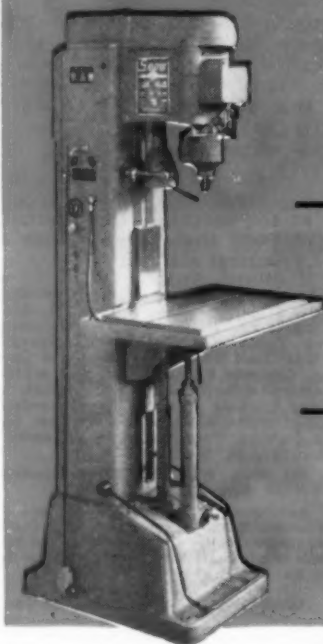
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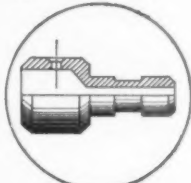
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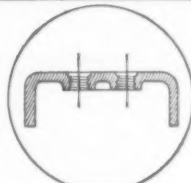
#### DRILLING

Crossdrill and C"V" Sink 1/16" Hole  
 Material—Brass  
 Production—4800 per hour  
 Fixture—#15 Vertical index  
 Equipment—#1-UD Drilling  
 Machine



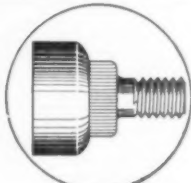
#### TAPPING

Tap Two #10-32 Holes  
 Material—Steel stamping  
 Production—3800 tapped holes  
 per hour  
 Fixture—#14 horizontal index  
 Equipment—#1-UT tapping  
 machine



#### THREADING

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## Good Reading

**A GUIDE TO SIGNIFICANT  
 BOOKS AND PAMPHLETS  
 OF INTEREST TO TOOL  
 ENGINEERS**

PLANT ENGINEERING HANDBOOK, a compilation of information by over eighty authors, each an authority in the field covered. Published by McGraw-Hill Publishing Co., New York. 2007 pp; price \$15.00.

This book, of which William Stanbury is editor-in-chief, is encyclopedic in coverage of plant engineering; runs the gamut from basic industrial engineering through equipment and installation to patent laws.

One interesting section is devoted to management engineering; embracing elements of supervision and tools of supervision; work simplification; incentive wage methods; and administration of job evaluation plans. A section on building starts with soil and rock and extends to roof. The balance of the work covers plant engineering with thoroughness that leaves little to be desired, the whole providing an invaluable reference for plant engineers.

#### THE ENGINEERING METHOD

John Charles Lounsbury Fish. Published by the Stanford University Press. 190 pp.; price \$3.00.

On the whole a somewhat academic work, yet simply phrased and interspersed with a dry humor and otherwise relieved by homely comparisons—the sort of book that keeps one reading once it is opened.

Starting with a few chapters on logic and reasoning, it leads into sharpening terms to be used in special work. No technical problems are then solved by way of illustrations, and steps of the method enlarged. Further on, the author discusses practical problems from the engineering the hypothetense of a right triangle to its practical application in supplying a city with water. The book ends with the ways in which the engineer deals with uncertainties.

#### MACHINABILITY OF METALS

Norman E. Woldman and Robert L. Gibbons. Published by McGraw-Hill Book Co., New York, N. Y. 517 pp; illustrated; price \$7.50.

This book is a practical manual that explains the metallurgy and machining characteristics of the different metals and their alloys and the method of selecting the proper tooling material and processing for easy and satisfactory machining.

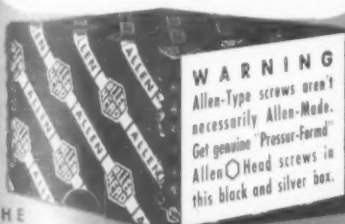
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It suggests tool design, cutting speeds, feeds and type of cutting fluid which, combined, provide the better end results, and separate chapters are devoted to low-carbon, tool, die, and stainless steels, cast irons, and the various non-ferrous metals.

Also included are theoretical considerations of machinability and the mathematical derivations. In addition to high speed machining, it further takes up the machining of refractory metals such as tantalum, molybdenum and tungsten, and non-metallics including glass, rubber and plastics.

**MATERIALS HANDLING CASE BOOK**, edited by Lewis K. Urquhart and Carroll W. Boyce, respectively managing editor and industrial production editor of *Factory Management and Maintenance*. Published by McGraw-Hill Book Company, New York, N.Y. 440 pp., price \$8.00.

This is a practical reference volume that tells, in actual case histories, how leading manufacturers have solved specific materials handling problems in their own plants. While the problems presented apply to the plant discussed, however, the solutions are applicable to materials handling problems in general so that, somewhere, the reader may find suggestions to fit his own needs.

Because the need to solve specific problems of materials handling occurs in practically every stage of manufacture, the editors have arranged the contents according to where the plant problem exists—clear through from receiving to shipping. A triple index enables the reader to quickly find the basic facts applicable to his own problems.

**MECHANICAL MEASUREMENTS BY ELECTRICAL METHODS**, by Howard C. Roberts. Published by The Instruments Publishing Co., Inc., Pittsburgh, Pa. 358 pp.; price \$4.00.

This book is written for the purpose of providing a wider acquaintance with electrical gaging principles; particularly, to coordinate measuring methods developed by engineers in various fields. The book is divided into two parts, the first of which discusses principles of operation; gaging methods based on variations of capacitance and variations of resistance; photoelectric and piezo-electric gaging methods; bridge and potentiometer circuits, and indicating and detecting instruments.

Part 2 covers equipment; calibrating devices; calibration-checking circuits; oscillographs; power supplies; amplifiers and computing devices; and self-contained gaging systems. All subjects are clearly illustrated and the book as a whole provides a clear-cut approach to electrical gaging.

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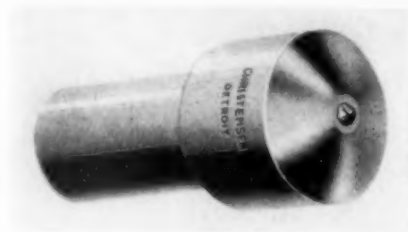
One of the important reasons why he received his franchise, was his high reputation for alert customer service. He maintains the most complete stocks possible, to assure immediate delivery.



INDICATE A-7-97

## Diamond Wheel Dresser

A complete line of single-point diamond wheel dressing tools is announced by the Christensen Diamond Tool Co.,



9607 Traverse St., Detroit 13, Mich. Manufactured in a full range of sizes for all grits of grinding wheels, the tools feature an exclusive "C-Metal" mounting method for holding the stone. As claimed, this mounting assures the diamond always holding its setting without regard to the severity of vibration or the intensity of alternate heating and cooling caused by frequent wheel applications.

Each tool contains one whole natural diamond, ranging from fractional to 3 carats in size. The tools are designed for use on any straight-face or form

wheel dressing operation, and are said to be especially useful for shops where diamond usage is relatively low, where a diamond tool may be issued to each individual operator. According to the manufacturer, the tools are sold under an unconditional guarantee of satisfaction.

T-7-98

## Improved Grinder

Major improvements for the 10x24 in. Type CH hydraulic universal grinder announced by the Landis Tool Company, Waynesboro, Pa., include the latest design swinging-type internal grinding fixture which was previously available on the 12 in. universal grinder only. This fixture, driven by a 1 hp. motor, has been developed for quick changeover from external to internal grinding operations.

The housing on which the motor is mounted, and in which the internal spindle is fitted, is hinged to a casting mounted on the wheelbase. The angle of the tapered bearing type so that any play which may develop can be readily eliminated. A variety of internal spindles and grinding quills is available.



Also available for operations that require an internal grinding fixture with additional power is a removable type internal fixture driven directly from the regular wheel drive motor.

Another feature available on the 10 x 24 in. Type CH universal grinder is a hydraulic-type, rapid wheel positioning mechanism which rapidly advances or retracts the wheelbase as needed. It is not a grinding feed, but in cases where internal and external grinding is done in one setup, it eliminates the need of manually turning the hand wheel in order to position the grinding wheel. The action of this mechanism is controlled from a lever, at the front of the machine, which controls both speed and direction. A safety interlock prevents it from being inadvertently operated during a normal grinding set-up.

T-7-982

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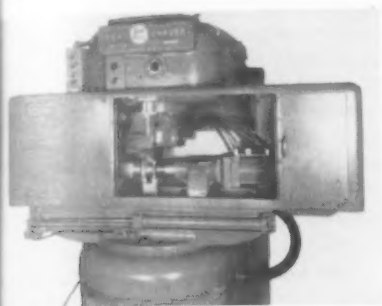
**TAPPING ATTACHMENTS**

**DRILL & TAP CHUCKS**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-98

## Semi Automatic Loading

A means of increasing the production of shaved gears, Red Ring engines of the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich., has developed a means of semi-automatic loading which is applicable to that company's diagonal gear-shaving machines.



Semi-automatic loading is accomplished by equipping the gear shaving machine with an air-actuated tail-stock. An automatic splash guard and a pre-locator and stripper supports the work until it is engaged by the advance of the tailstock.

After the operator lays the work gear on the pre-locator, he pushes the start button to star the cycle, which follows automatically. The splash doors close, the tailstock advances to engage the work, the coolant flow starts and shaving begins. At the end of the shaving cycle, both the cutter and coolant flow stop, the tailstock retracts and the splash doors open, all automatically. Thus, all that is required of the operator is putting the work gear on the pre-locator and removing the shaved gear at the end of the cycle.

**T-7-991**

## Electric Tachometer

Now available from U. S. Electric Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, Calif., is an electric tachometer arrangement designed to provide continuous and accurate speed indication for variable speed motors. This Model R-1 tachometer and generator is available in ratings  $\frac{1}{4}$  to 50 hp and speeds from 2 to 10,000 rpm.

Coupled to a U. S. Varidrive, the generator requires no other source of power, while the totally enclosed tachometer can be remotely mounted at distances up to 300 ft. The indicator dial shows operating speed as a percent of the Varidrive maximum speed; that is, if the Varidrive speed is 1000 rpm and the dial indicates 60 percent, then the Varidrive speed would be 600 rpm.

**T-7-992**

USE READER SERVICE CARD ON PAGE 85 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

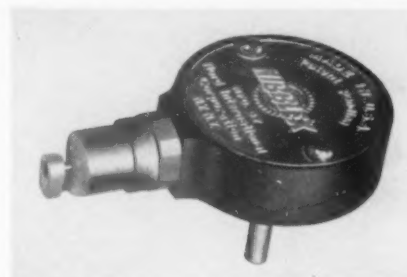
## Nibbling Attachment

A cutting attachment for sheet metal that fits any  $\frac{1}{4}$  in. electric or air drill may be used to cut sheet steel up to 18 ga. and 16 ga. copper, brass or tempered aluminum. Called the Nibblem and actually operating on the principle of a nibbler, the tool is said to cut corrugated sheets as easily as flat stock. Average speed at 2000 rpm is 7 ft. per minute.

In addition to the usual straight and curved cuts, the tool is said to permit cutting circles from 2 in. diameter up; also, corrugated sheets may be cut

without deformation by using a side cutter punch. Available from Nord International Corp., 50 Church St., New York 7, N.Y.

**T-7-993**



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## Technical Shorts . .

AS DEMANDS FOR aluminum curtail the amount of metal available for civilian use, manufacturers can produce more parts from a given amount of metal by following recognized conservation practices. Plants fabricating parts from sheet and bar stock could possibly have scrap losses of from 20 to 40 percent—perhaps as high as 60 percent. Usually such losses can be reduced.

The following points have been organized by The Aluminum Association as a recommendation to those in industry facing these problems.

Design engineers, with an eye toward using less metal to do a job, may find that thinner sections, properly reinforced, would be as satisfactory, and also would have the superiority of lighter weight.

Consider whether an alloy of higher strength may be used so that the same strength may be obtained from thinner sections.

Care should be taken to avoid those particular high strength alloys so in demand for defense that they are virtually unavailable for civilian use, but where the substitution can be made, more parts can be produced per pound of metal.

In this same vein, it may be found that for parts already in production, a lighter gage sheet of a higher strength alloy may be substituted directly without change in parts stamped or drawn from sheet.

Manufacturers using sheets should check carefully the sizes being used and whether or not they are being utilized most efficiently. Sometimes changing the sheet size will reduce scrap from blanking and forming operations. However, standard mill sizes should be specified whenever possible.

In the factory, too, the first point is "conservation consciousness" among the workers. Eliminating practices such as continuing to operate a faulty machine, using dull tools, working with improper set-ups, faulty workmanship and handling the product carelessly can stretch available materials over longer production runs. (And the workers' schedules depend on available materials and how efficiently they are used.)

In the foundries, care in processing and handling molten metal will reduce scrap losses as well as result in better products. Freedom from contaminating

substances will result in a higher proportion of sound castings and therefore less scrap to be remelted and reprocessed.

In plants manufacturing products from sheet or bar, forms of scrap possibly may be used in the production of smaller parts. Shifting the layout so as to produce pieces of larger size may permit pieces to be used more efficiently. Rejects that cannot be repaired sometimes can be salvaged in other ways, while in some cases, parts obsoleted by design changes may be altered for use elsewhere.

The Association presents three rules to help the manufacturer to realize full value of aluminum scrap:

(1) Keep it fully segregated by alloy and type of scrap; (2) keep it as clean as possible; (3) keep it free of foreign material.

**T**HEORY AND APPLICATION of feedback control systems (servomechanisms), and the broad concept of "system engineering" will be the subject of a special 10-day course at the Massachusetts Institute of Technology beginning August 20.

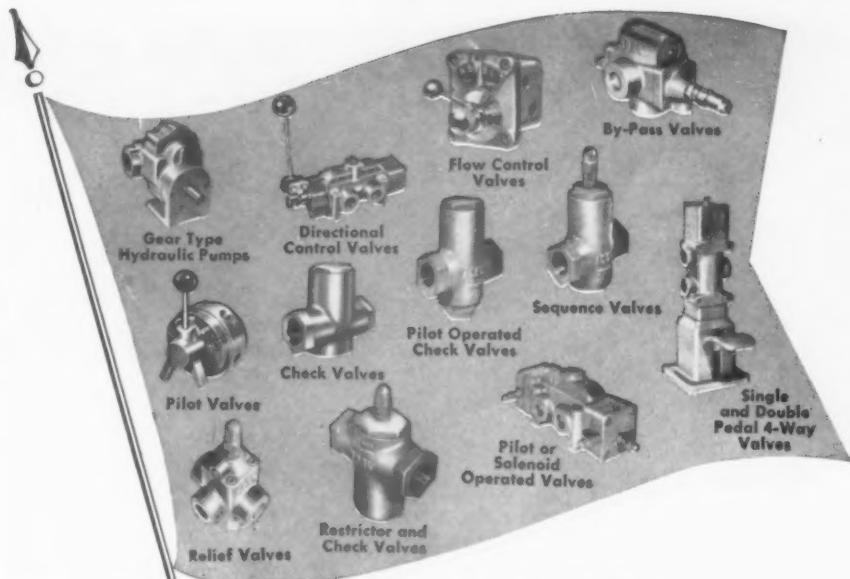
A survey of the theory with emphasis on dynamic operations and system synthesis will be included in the program as well as study of industrial applications in such diverse fields as steel making, printing, petroleum processing, wood working and power distribution.

Demonstrations and laboratory work will include measurement of system and component performances and methods of testing and evaluating process control equipment.

The program will be under the direction of Prof. Donald P. Campbell of the M.I.T. department of electrical engineering, assisted by others in the field.

**T**HE FITTING AND porosity which generally characterizes phosphor bronze arc welding such as is often required in general maintenance work and repair may no longer be a problem to maintenance men working on bearings and parts requiring a smooth surface for corrosion-resistance.

According to Bent Laune, president of All-State Welding Alloys Co., who offers the trick to help those faced with current replacement problems, a nice smooth face may be obtained by "surface washing" with a low temperature phosphor-copper-silver brazing rod. This is "washed" on with a neutral or excess-acetylene flame, a Prest-O-Lite torch or oxy-city gas flame. Its low working temperature causes it to flow readily into the cracks and pits within the area of its application.



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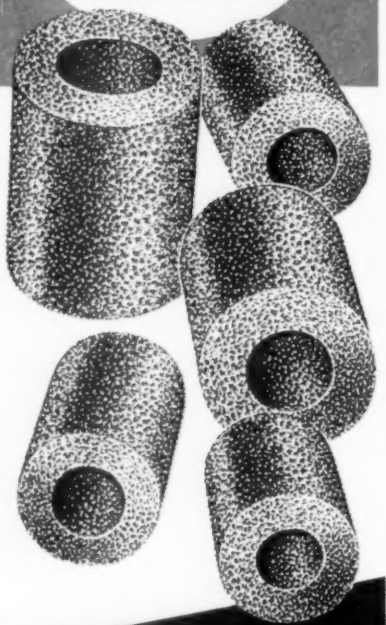
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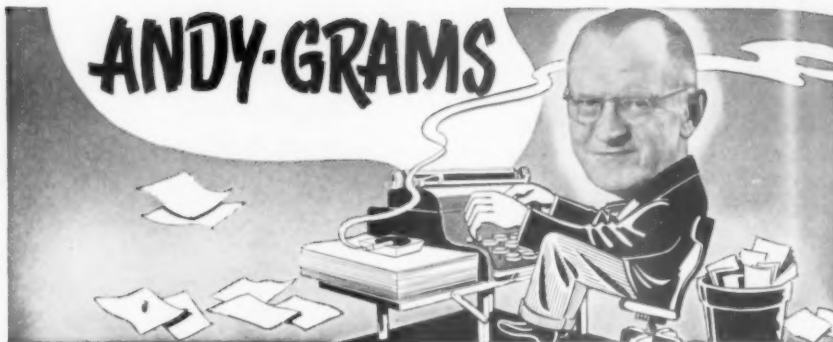
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INDICATE A-7-102

## ANDY-GRAMS



Having had a busy month and still extended to make the deadline, I'll ask readers to bear with a slap-happy jumble of thought as it comes to mind. To start with, the current Tool Engineering Report took me hither and yon gathering data and illustrations on late developments in broaching.

During the itinerary, called on Apex, Colonial and Detroit Broach Companies for specialties in their lines, then pestered National Broach and Machine, Cincinnati Milling Machine and Foote-Burt for pics and applications. A long distance call to Joe Crosby of Lapointe Machine Tool, who responded nobly as befits an ASTE Director, and further fenagled some applications out of Oil-gear.

Not that I had to go begging; never had such wonderful cooperation as was extended me by the members of the broaching industry. To make a pleasant if hectic chore more pleasurable, I had opportunity to visit American Broach & Machine Co., in Ann Arbor; on the occasion of their plant tour held for members of Waterloo chapter and coincidental with the chapter's monthly meeting.

Thanks to Dale Black and Jim McCollum, chapter ch'man, I was privileged to sit at the head table with the brass and so enjoyed a fine dinner besides having a grandstand view of erudition represented by U of M faculty members including our own Prof. Boston. Had a really wonderful evening.

Naturally, I couldn't get around to the entire broach industry; for that matter, can't begin to use a tithe of the material gathered in the one report. Saving the rest for a later story. Anyway, thanks a million to everybody concerned, and here's hoping the experts won't be too critical of a report which, in view of space limitations, could only touch the high spots.

On June 4, went up to Fond du Lac, Wisconsin, where Giddings & Lewis took the wraps off their latest *opus* to the edification of scribes invited to a press preview. What a machine!—but then, you can read about in in the Tools of Today section, this issue. At that, the one page does scant justice to an outstanding job of tool engineering.

While there, had a brief "hello" with Bill Rutz, who was called away on another meeting; a smile and a hand-shake with Erwin Kaiser and the time o' day with Harry Soukup, both looking fine and the same since I visited Fond du Lac chapter several years ago. People seem to wear well in the small towns. Missed Ray Woytych, who was visiting in Canada, but had a pleasant get-together with Sid Little, now retired—if he'll stay that way. I wouldn't.

Along with the rest of the visitors, enjoyed the hospitality of Don Laffin, hosting for G & L; then, homeward bound, swapped fish stories with G & L's Harold Johnson, General Electric's Earl Dunkel, Erle Ross, George Buchler and Ben Brosheer, respectively with *Steel*, *Machinery*, and *American Machinist*. We sure did some tall fishing, best man win.

On June 14, attended Detroit chapter's meeting, where the brass was so thick they had to have head tables and a reserve besides. (Will somebody please explain the coffee speaker's gag about the old maid and the parrot? I didn't get it.) Noted among those present were long-time-no-see Otto Winter, Roger—alias George—Waindle, Herb Tigges, Grant Wilcox, Les Bellamy, Slim McClellan and other past and future ASTE presidents. A really hang-up meeting highlighted by an address by General Merle H. Davis, for which see *The ASTE News*.

On June 12, attended a dinner at the Stockholm in honor of the AIK secret

**The Tool Engineer**

team from Sweden, of which Gust Headlund of Apex Broach was sponsor for their Detroit appearance. A fine group of athletes! Then, on Wednesday eve the 19th, saw them play the Michigan-Ontario All Stars, the latter team out-classed a/c having had no time to practice together.

At that, the "invaders"—as the local press called them—used their heads—and literally. One player would bounce a kicked ball off his head, then to another, and so on boomp, boomp, boomp until they'd butt it close to the goal. Not that they were lacking in footwork: Willie Hoppe at his best couldn't have cued a billiard ball with more finesse. Oh yes, they won, the proceeds of the game going to Percy Jones Hospital. Anyway, it was the first time I'd ever seen a soccer game except as a movie flash, but from now on I'm a fan. It's a fast game.

From one thing to another, I've a raft of letters to answer, most of them friendly and perhaps undeservedly complimentary. I'll get around to it after a while. In this connection, have any of you ASTEers N.E.W.S. sent a card to Ray Gifford, as I asked you to in the June Andygrams? If you haven't, do it now—please!

Speaking of letters, I sent one to each of chapter chairmen a few days ago, which I hope they'll act on a/c the proposal mentioned promises a closer coordination of our collective resources of tool engineering know-how. With a limited staff on *The Tool Engineer*, we can't be everywhere although we do get around—and then have to scabble like heckelfelt to make up the time. What we want is a live news reporter in every ASTE chapter.

Well, that's about all for now. Like the rest of you, I'm looking forward to sunshine and picnics during the summer months although, at that, there's not much rest for the weary in this game. No matter where you are, there's always the deadline in the offing, and deadlines, like trains, have to be met on schedule. Anyway, here's to happy vacations.

Which reminds me that, ere long, I'll be heading for California, there to become another "native son" like Karl Dues, Hans Bamberger and other As-teers who heeded Greely's advice, "Go West, Young Man." Before pulling out, however, I'll try to tell you that funny story I promised before putting the final "30" to the column.

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## Low-Cost Production Inspection

This versatile, simplified version of the Kodak Contour Projector will fit into *your* inspection and assembly line. With it you can handle a wide variety of precision jobs, large or small.

Fast, accurate, and needing no cumbersome hoods or curtains, it takes little skill to operate. Gauging takes less time, is more complete. And experience has shown that fixtures for optical inspection outlast mechanical gauges by as much as ten to one.

If your work calls for examination of surface details and deep recesses, or requires vertical projection, there are accessories to do the job. Lenses are available for magnifications up to 100X. All optical parts are dust-sealed—never need adjustment.

We'll be glad to show you how this adaptable new instrument will work on your problems. Write to Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

### the KODAK CONTOUR PROJECTOR, model 3

Distributed by ENGINEERS SPECIALTIES, Buffalo 9, N. Y.

\*List price, F. O. B. Rochester, N. Y., magnification lenses and accessories extra. Price subject to change without notice.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-103

# North East West South IN INDUSTRY

Ralph W. Burk recently was elected vice-president for manufacturing for **Kearney & Trecker Corp.** Simultaneously, the appointment of **Andrew K. Wilson** as director of industrial relations and head of the personnel department was announced. Mr. Burk, formerly vice-president of sales, has been associated with Kearney & Trecker since 1927, while Mr. Wilson joined the company in 1935.

R. Ruzicka, associated with **The R. K. LeBlond Machine Tool Co.** for the past ten years, has been appointed manager of installation and service. In this capacity Mr. Ruzicka will coordinate various LeBlond projects in relation to the defense effort as well as supervise the installation of this type of equipment. He will continue with his former duties as assistant sales manager.

At a meeting of the board of directors of **The Bullard Co.**, **E. P. Bullard** resigned as chairman. The board unanimously voted to name him chairman emeritus through formal resolution honoring him.

**Frank H. Bishop** was elected executive vice-president of **Allied Products Corp.** at the company's recent board of directors' meeting. Mr. Bishop previously was a vice-president of the corporation.

**Everett M. Hicks**, manager of **Norton Company's** Grinding Machine Division, has been appointed a member of the Industry Advisory Committee of the Office of Price Stabilization. This committee, composed of 16 members, will advise the OPS on price regulations affecting the machine tools industry.

The board of directors of **Buckeye Tools Corp.** has named **Albert G. Lazon** president and **Hal O. Gummer** vice-president and general manager of the organization. At the same time **Ervin Reeves** was appointed treasurer and **Earl Hamilton** secretary of the company.

**Glen A. Wilson** has been appointed general superintendent of the Carbide Division of the **Firth Sterling Steel & Carbide Corp.** Formerly associated with the Reynolds Alloy Co., Mr. Wilson joined Firth Sterling in 1949 as industrial engineer.



Glen Wilson



Leo Hunderup

Appointment of **Leo F. Hunderup**, vice-president and assistant general manager of the **Greenfield Tap and Die Corp.** has recently been announced. Mr. Hunderup for many years was executive vice-president of Van Norman Co. and its subsidiary the Morse Tool Drill and Machine Co. He also is a past president of the National Standard Parts Association.

## OBITUARY

**L. F. R. Bellows**, president of **The Bellows Co.**, died recently in Detroit. Mr. Bellows, who was 68 years old, founded Bellows & Co. in 1911 to manufacture electric signs. In 1940 he organized Bellows with Herbert B. Link in Akron.

## Coming Meetings

**June 14-16**, symposium on surface treatment sponsored by Armour Research Foundation of Illinois Institute of Technology, Sheraton Hotel, Chicago.

**June 11-14**, Semi-annual meeting of **American Society of Mechanical Engineers**; Engineering Institute of Canada and Institute of Aeronautical Sciences also participating, Royal York Hotel, Toronto.

**June 11-16**, First National Congress of Applied Mechanics, Illinois Institute of Technology, Chicago.

**June 14-16**, 17th annual meeting of **National Society of Professional Engineers**, Minneapolis.

**July 30-Aug. 2**, American Electroplaters' Society convention, Statler Hotel, Buffalo.

## H.S.S. Hardening

## The Sentry Way!

**Promotes "Good Housekeeping" in the Hardening Room at HY-PRO!**

The HY-PRO TOOL CO., New Bedford, Mass., has given its Sentry Furnaces a special industrial seal of approval for "good housekeeping." HY-PRO emphasizes these Sentry performance facts: No exhaust gases to burn off . . . simple to operate; operator can devote full time to production without tending complicated atmospheric controls . . . minimized part cleaning after heat treating . . . the best way to avoid decarburization of Moly H. S. S.

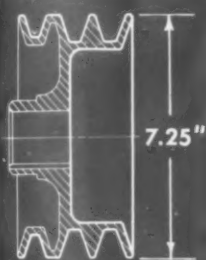
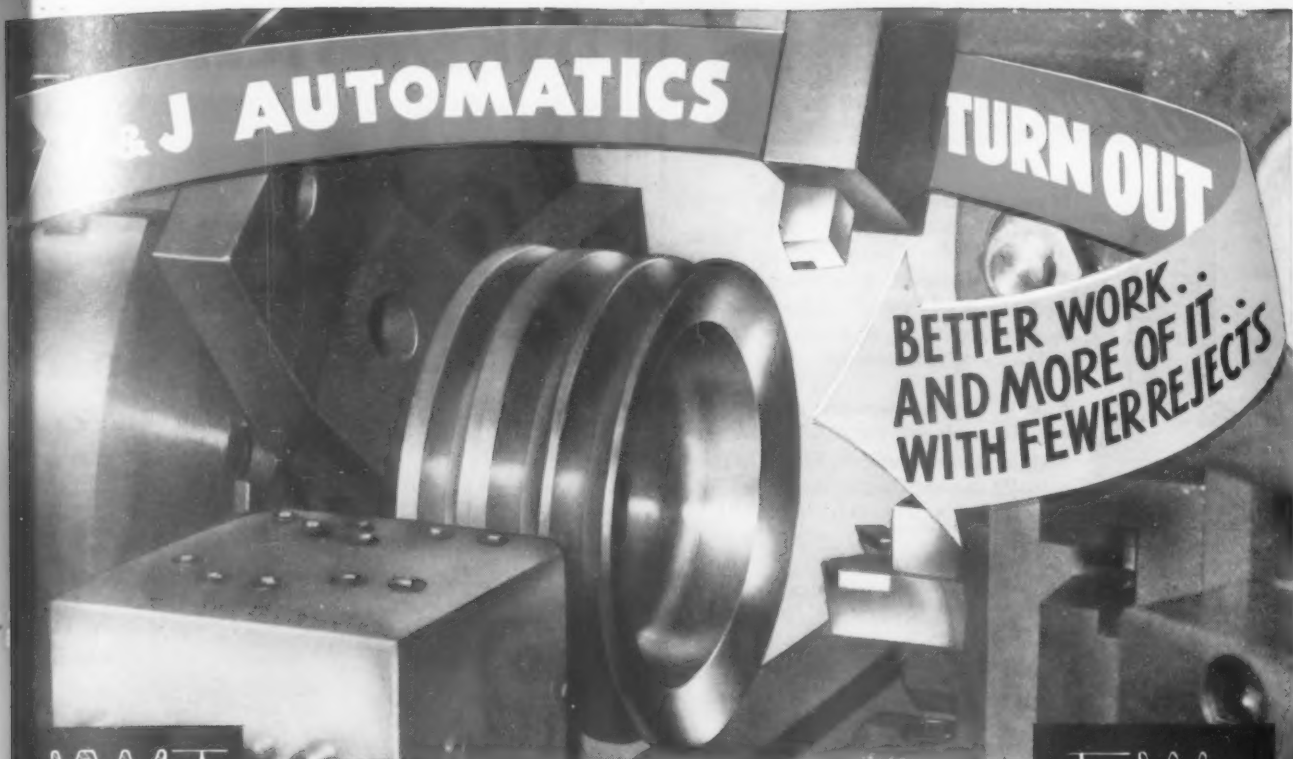
ASK FOR CATALOG

## The Sentry Company

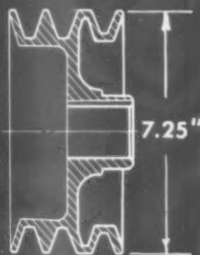
INDUSTRIAL ELECTRIC FURNACES AND EQUIPMENT  
FOR HEAT TREATMENT OF METALS

"Always on Duty" **FOXBORO, MASSACHUSETTS**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-104



1ST OPERATION



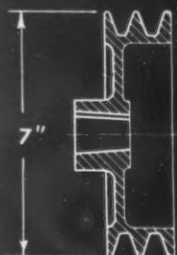
2ND OPERATION

When it comes to machining Pulleys on a precision-production basis, there's no more versatile equipment for the job than P&J Tooling on the P&J Automatic. A single Machine can be tooled efficiently to turn out varied jobs with similar operations — such as roughing and finishing all diameters and flat surfaces . . . boring and reaming holes, whether straight or tapered . . . facing webs and hubs . . . forming radii and grooving sheaves to the precise angles specified. For example: a single combination of P&J Tooling on the 5D Automatic (photo above) mass-produces the two Pulleys illustrated (left and right) in a single setup. Heavy lines indicate surfaces machined.

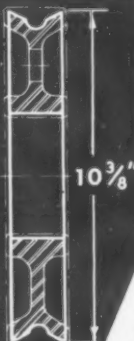
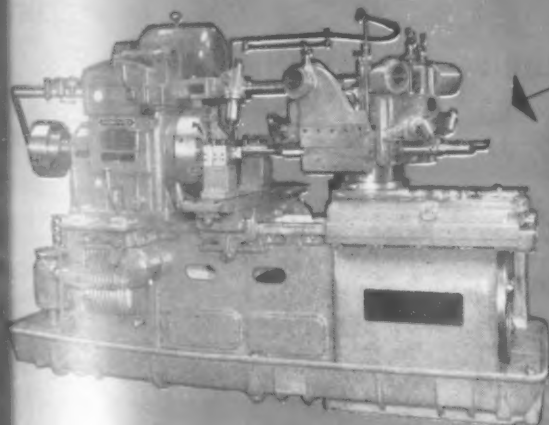
Whatever the size and class of finish — whether single or multi-grooved — P&J Tooling on the P&J Automatic will give you outstanding production and economy. P&J's more than 50 years' experience proves it . . . so why not send your prints for tooling recommendations and time estimates?



1ST OPERATION



2ND OPERATION



10 3/8"

— and here is another P&J Automatic — the 5DE — with a single combination of P&J Tooling set up for precision-machining varied work of similar nature: 5.480" dia. Chucking Rings and 7.993" dia. Pistons and (as illustrated) 10.375" dia. single groove Sheaves.

**POTTER &  
JOHNSTON CO.**

PAWTUCKET, R. I.

subsidiary of PRATT & WHITNEY  
Division Niles-Bement-Pond Company



## Fewer REJECTS!



If you are striving to reduce the number of rejects on tapping and reaming jobs, just get a Ziegler Floating Tool Holder! Because it always floats freely, it compensates for inaccuracies in setup, even of as much as 1/32" radius or 1/16" diameter.

This is why it solves the problem of oversize and bell-mouthed holes. It may be hard to believe, but once you actually use the Ziegler Holder, all of your doubts will quickly vanish.

Get a Ziegler and see how it will put an end to your misalignment difficulties.

**W. M. ZIEGLER TOOL COMPANY**  
13574 Auburn Avenue Detroit 23, Mich.

*Ziegler*  
ROLLER  
DRIVE

WRITE FOR  
CATALOG

**FLOATING HOLDER**  
for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-7-106-1

WHEN ACCURACY COUNTS...

Contact **SCHERR!**



*The Wilder*  
**MICRO  
PROJECTOR**  
with the  
**VERTICAL  
DESIGN...**

- OPTICAL PROJECTION DETECTS ERRORS
- HORIZONTAL STAGE: NO CLAMPS NEEDED
- COMFORTABLE INCLINED SCREEN
- MICROMETER CROSS SLIDE ADJUSTMENTS

SEND FOR ILLUSTRATED BULLETIN  
OR ASK FOR OUR REPRESENTATIVE  
TO DEMONSTRATE THE "VERTICAL  
DESIGN" PROJECTOR...

**GEORGE SCHERR CO., INC.**  
200-C LAFAYETTE STREET  
NEW YORK 12, N. Y.

USE READER SERVICE CARD; INDICATE A-7-106-2

## DYKEM STEEL BLUE STOPS LOSSES

making dies  
& templates

Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-7-106-3



**WHO**

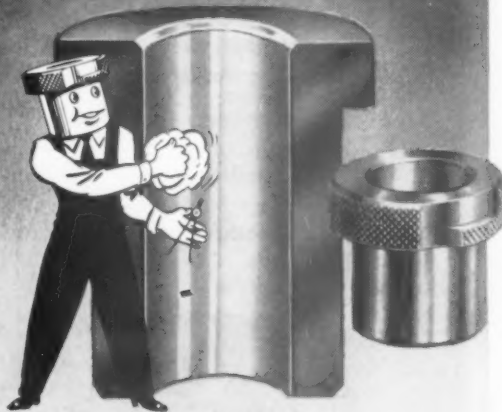
looks more like a busy, little beaver than a wise, old owl these days. But WHO\* is still—

*Wm. H. Ottmiller\**  
of YORK, PA.

Even though the need for our precision, "milled-from-the-bar" screw machine products has us virtually snowed under—we invite inquiries from those of you who must have "the best."

USE READER SERVICE CARD; INDICATE A-7-106-4

## PRECISION MADE



FOR PERFECT ALIGNMENT  
and LONGER WEAR

*American* DRILL JIG **BUSHINGS**  
SAVE YOU MONEY

Send for catalog and name  
of nearest distributor

Look for the trade mark **A**

*American Drill Bushing* CO., INC.  
5107 Pacific Blvd., Los Angeles 58, Calif.  
SPECIALIZING ONLY IN DRILL BUSHINGS

USE READER SERVICE CARD; INDICATE A-7-106-5

The Tool Engineer



**Q:**

What makes Hannifin Cylinders better?



**A:**

Their many exclusive features! ONE is that every Hannifin Cylinder is "TRU-BORED"\* from heavy wall steel tubing and honed to a satin finish.

\*Bored truly straight, truly round to assure less friction, longer seal life, lowest maintenance.



**Field Engineers  
in All Leading  
Industrial Centers**

Talk over your cylinder problems with Hannifin Engineers. They will make recommendations tailor-made to your specific requirements. Write for Bulletin 210.

If you check on each operation in the manufacture of hydraulic and pneumatic cylinders, you will know why Hannifin precision methods are superior. Cylinder bodies are piloted into end caps for permanent concentricity of parts; complete standardization is maintained for maximum interchangeability; all cylinders are identified with individual serial numbers registered for life in factory records—it is this careful workmanship and attention to detail that assure maximum utility and minimum "down time" when you specify HANNIFIN CYLINDERS. Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

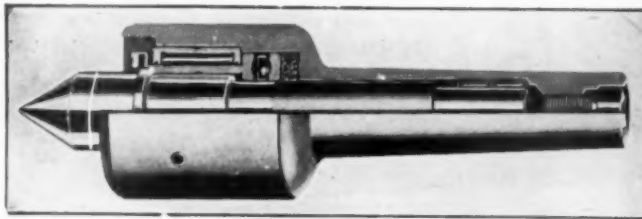
**THERE IS A HANNIFIN ANSWER TO EVERY HYDRAULIC AND PNEUMATIC CYLINDER NEED**



*do All you can do...with*

# HANNIFIN

# INCREASE PRODUCTION



These Ball and Roller Bearing Centers with the Exclusive OVERLOAD INDICATOR increase production, because work or centers will not burn out, regardless of how long the run. Well-engineered to provide years of trouble free service, even under the most severe conditions.



## ACME TOOL COMPANY

75 West Broadway

New York 7, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-108-1

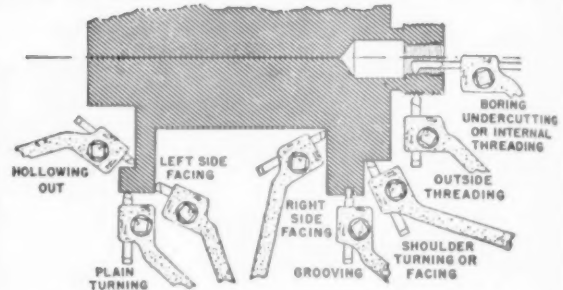


# CUT

TOOL COSTS  
80%

USE ONLY

## ONE TOOL HOLDER



This Universal Tool Holder can be used for any lathe, shaper or planer set-up, does internal boring and threading, is ideal for carbide tools. Bit sizes: 1/4", 5/16", 3/8", 7/16".

GEORGE L.

# Detterbeck Quality Tools

SPEED UP  
Screw Machine Production

SELECT  
YOUR NEEDS  
FROM THIS  
LIST

We specialize in  
CUTTING CAMS

HIGH SPEED STEEL AND  
CARBIDE FORM TOOLS

SPECIAL CUTTING TOOLS

SPLIT DRILL BUSHINGS

CROSS SLIDE KNURL HOLDERS

TOOL BITS

BOX TOOLS

BURNISHING TOOLS

REVOLVING STOPS

RECESS SWING TOOLS

FORMING SWING TOOLS

Inasmuch as we manufacture cams and tools for the trade we obviously do so on a production basis. As a result we offer:

1. Superior type tools . . . at low cost.
2. Practical design based upon many years of experience.
3. Correct specifications which insures maximum service.

Your tool requirements in our hands is your guarantee of better tools at a great saving.

### PROMPT DELIVERIES

Tool making with us is a routine matter. Special equipment . . . skilled hands . . . plus know how, enables us to fill orders in a minimum of time.

### SERVICE

Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools. Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

### COMPLETE ENGINEERING

GEORGE L. DETTERBECK CO., Incorporated. 1871 Clybourn Ave., Chicago 14, Ill.  
ENGINEERS TO AN INDUSTRY

USE READER SERVICE CARD; INDICATE A-7-108-2

### DRILL HARDENED STEEL WITHOUT ANNEALING WITH "HI-ROCKWELL" DRILLS

Every toolroom needs Champion "Hi-Rockwell" drills. These tools drill precision holes in steels testing C-40 to C-68 Rockwell quickly and without annealing. Ideal for reworking tools and dies, they actually cut a curled chip! **THEY CUT!!!**

Some sales territories open.

Available in standard sizes—from stock of:

## CHAMPION TOOL CO.

24060 Orchard Lake Rd.

Farmington, Michigan

We also are the  
manufacturers of the Nu-Mikro piston grooving tools.

USE READER SERVICE CARD; INDICATE A-7-108-3



## MACHINES and TOOLS

FOR CUTTING

. . . SHAVING

. . . BURNISHING

AND INSPECTION

## in GEAR PRODUCTION

THE FELLOWS GEAR SHAPER COMPANY, SPRINGFIELD, VERMONT

USE READER SERVICE CARD; INDICATE A-7-108-4

The Tool Engineer

**"STANDARD"**  
recommends  
**STANDARDS\***

**UNBRAKO**

# PRECISION-GROUND DOWEL PINS

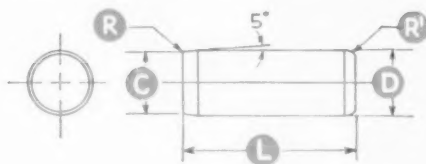


Standard Pin—.0002 over listed diameter) Furnished unless otherwise specified.  
Standard Oversize Pins—Available ONLY in sizes marked with asterisk (\*)  
(.001 over listed diameter) Furnished only when specified.

D	L	Price per dozen	Quantity per pkg.	D	L	Price per dozen	Quantity per pkg.
Diameter	Length			Diameter	Length		
1/8 (.1250")	* 3/16 * 1/2 * 5/8 * 3/4 * 7/8 * 1 1/4 * 1 1/2 * 1 3/4 2	.60 .61 .62 .65 .68 .72 .79 .88 .96 1.04	12 12 12 12 12 12 12 12 12 12	3/8 (.3750")	* 2 * 2 1/4 * 2 1/2 * 3	1.65 1.83 2.01 2.37	12 12 12 12
3/16 (.1875")	* 1/2 * 5/8 * 3/4 * 7/8 * 1 1/4 * 1 1/2 * 1 3/4 * 2	.66 .68 .70 .74 .77 .85 .95 1.04 1.14	12 12 12 12 12 12 12 12 12	7/16 (.4375")	* 1 1/4 * 1 1/2 * 1 3/4 * 2 * 2 1/2 * 3	1.55 1.69 1.85 2.01 2.16 2.58 3.00	12 12 12 12 12 12 12
1/4 (.2500")	* 1/2 * 5/8 * 3/4 * 7/8 * 1 1/4 * 1 1/2 * 1 3/4 * 2 * 2 1/4 * 2 1/2	.73 .75 .78 .82 .85 .94 1.05 1.16 1.29 1.44 1.62	12 12 12 12 12 12 12 12 12 12 12	1/2 (.5000")	* 3/4 * 1 1/4 * 1 1/2 * 1 3/4 * 2 * 2 1/4 * 2 1/2 * 3 * 3 1/2 * 4	1.81 1.96 2.10 2.24 2.40 2.58 2.80 3.06 3.66 4.34 5.04	12 12 12 12 12 12 12 12 12 12 12
5/16 (.3125")	* 1/2 * 5/8 * 3/4 * 7/8 * 1 * 1 1/4 * 1 1/2 * 1 3/4 * 2 * 2 1/4 * 2 1/2 * 3	.82 .85 .88 .92 .95 1.07 1.19 1.32 1.47 1.62 1.80 2.16	12 12 12 12 12 12 12 12 12 12 12 12	5/8 (.6250")	1 1 1/4 1 1/2 1 3/4 * 2 * 2 1/4 * 2 1/2 * 3 * 3 1/2 * 4 * 4 1/2 5	2.63 2.86 3.08 3.33 3.60 3.90 4.20 5.04 5.88 6.72 7.68 8.88	12 12 12 12 12 12 12 12 12 12 12 12
3/8 (.3750")	* 1/2 * 5/8 * 3/4 * 7/8 * 1 * 1 1/4 * 1 1/2 * 1 3/4 * 2 * 2 1/4 * 2 1/2 * 3	.93 .97 1.00 1.04 1.07 1.20 1.35 1.50	12 12 12 12 12 12 12 12 12 12 12 12	3/4 (.7500")	* 2 * 2 1/2 * 3 * 3 1/2 * 4 * 4 1/2 5 6	5.04 5.88 7.20 8.64 10.08 11.52 12.96 15.84	12 12 12 12 12 12 12 12
1 (1.0000")	2 2 1/2 3 3 1/2 4 4 1/2 5 6	9.84 10.80 12.00 13.92 16.08 18.24 20.40 24.72	12 12 12 12 12 12 12 12				

Prices subject to change without notice.

## LIST PRICES SUBJECT TO DISCOUNT



### UNBRAKO data highlights:

Surface hardness, Rockwell "C"

Scale: 60-62

Surface finish: 6 microinch max.

Core hardness, Rockwell "C" Scale:  
50-54

Average single shear strength:

150,000 p.s.i.

Diameter tolerance:  $\pm 0.0001$ "

BLUE label pins are standard: they are made  $\pm .0002$ " oversize to meet nominal requirements for press fits.

RED label pins are standard "repair pins" made  $\pm .001$ " oversize.

\* One of a series listing Standard UNBRAKO Socket Screw Products sold by your local UNBRAKO Distributor. If you want reprints of this and other advertisements in the series, ask for them on your business letterhead.

**SPS**

STANDARD PRESSED STEEL CO.

JENKINTOWN 37, PENNSYLVANIA

NOMINAL DIAMETER		1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
STANDARD	MAX.	.1253	.1878	.2503	.3128	.3753	.4378	.5003	.6253	.7503	.8753	1.0003
	MIN.	.1251	.1876	.2501	.3126	.3751	.4376	.5001	.6251	.7501	.8751	1.0001
OVERSIZE	MAX.	.1261	.1886	.2511	.3136	.3761	.4386	.5011	.6261	.7511	.8761	1.0011
	MIN.	.1259	.1884	.2509	.3134	.3759	.4384	.5009	.6259	.7509	.8759	1.0009
POINT DIAMETER	C	.116	.178	.237	.298	.359	.417	.480	.605	.725	.850	.975
TOP RADIUS	R'	3/64	3/64	1/16	1/16	5/64	3/32	7/64	1/8	1/8	1/8	1/8
BOTTOM RADIUS	R	1/64	1/64	1/64	1/64	1/64	1/32	1/32	1/32	1/32	1/32	1/32

Why specify "specials"? Standardize on UNBRAKO standards!

# Here's PREPAREDNESS of the Soundest Kind

## 3 Brown & Sharpe Machines

that equip you to mill  
small and medium-sized parts  
fast, accurately, economically

The greatest service you can render to your company today, is to make sure that your plant facilities are prepared to meet increasing demands for accurately-made small and medium-sized parts at low cost.

That is why it will pay you to investigate the three manufacturing-type Brown & Sharpe Milling Machines shown here. They are specifically designed for mass producing milled parts, with uniformly high precision and minimum demand on the operator's time and attention. Adapted to an almost endless variety of jobs, they assure you continuing big returns on a moderate capital investment. Write for detailed catalog and specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

### No. 12 PLAIN MILLING MACHINE 3 h.p. Spindle Drive

Complete electrical control of all power movements gives unusually precise, smooth performance with outstanding ease and flexibility of operation. Wide variety of automatic cycles obtainable, with time-saving dual feed rate. Ample capacity for the majority of medium-sized work. Climb milling in either direction permitted by built-in backlash eliminator.

### No. 000 PLAIN MILLING MACHINE 1/2 h.p. Spindle Drive

For economical, fast production of small pieces such as parts for firearms, sewing machines, radios, etc. Automatic cycle and minimum fatigue for operator afford uniform rate of production. Uniform, positive feed gives long cutter life.

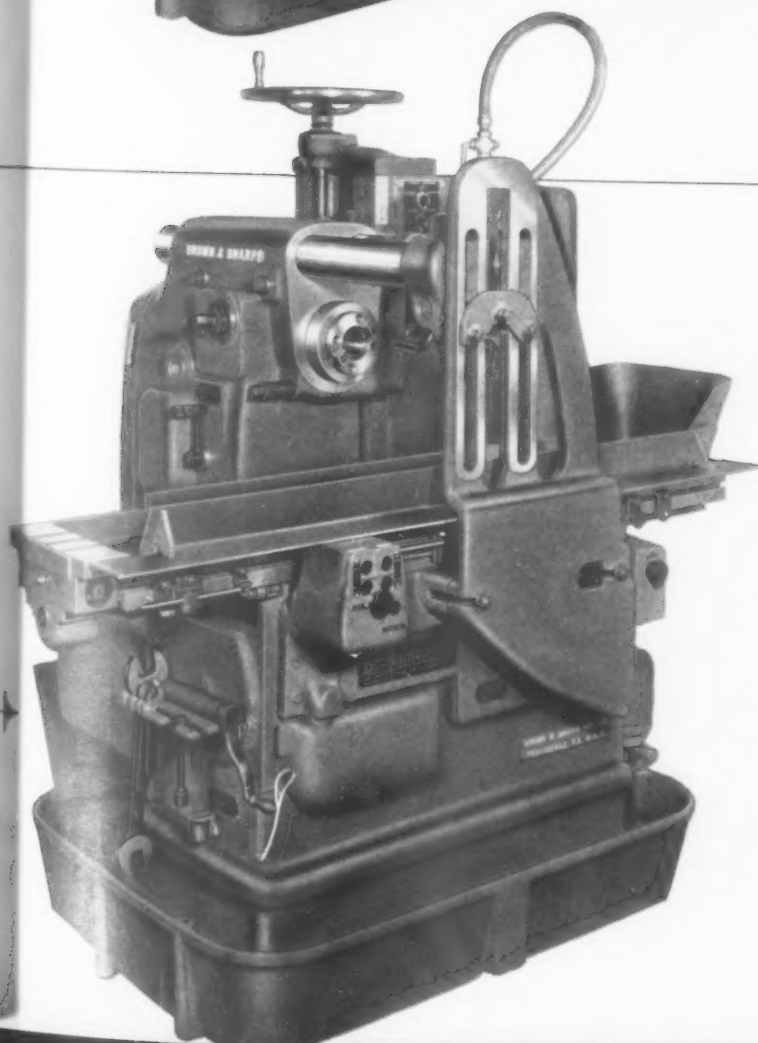
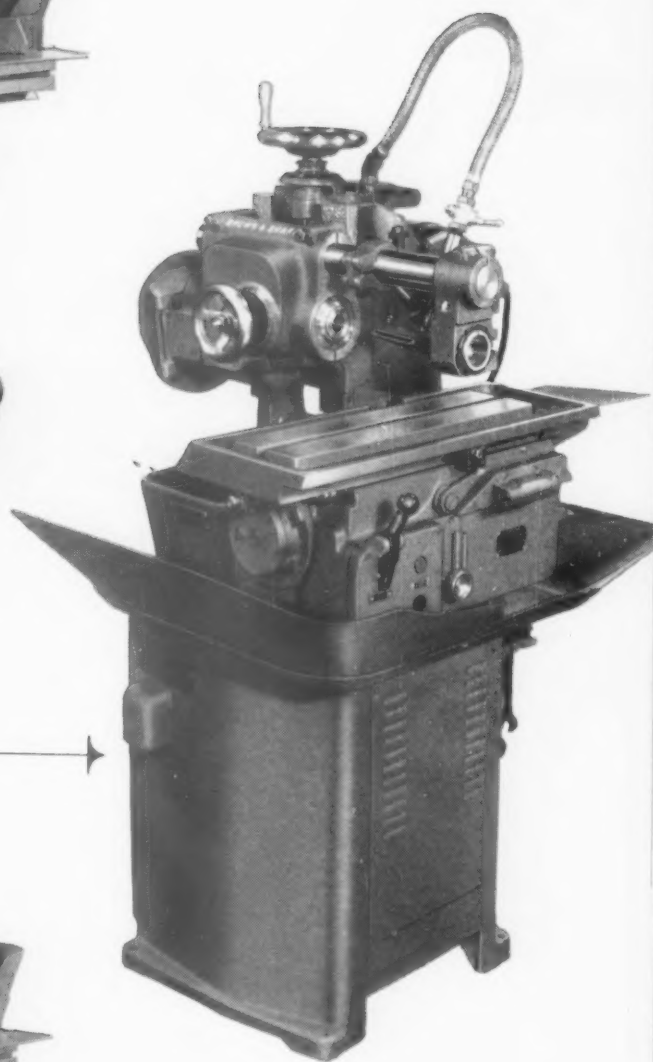
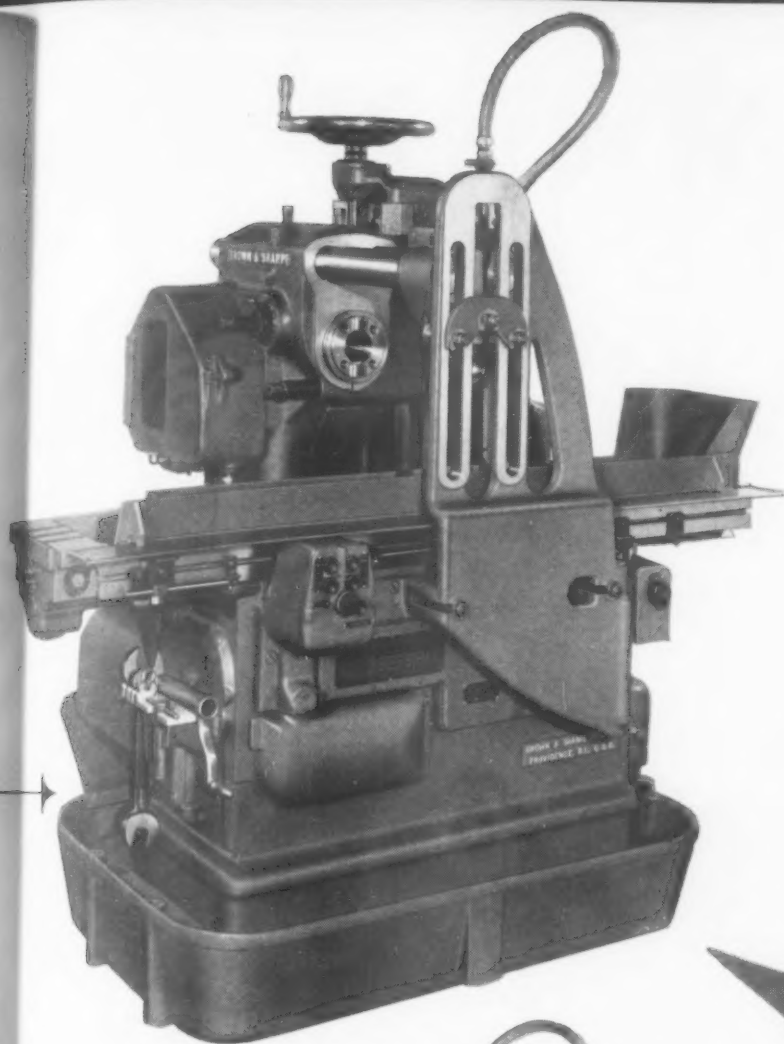
### No. 12 PLAIN MILLING MACHINE 7 1/2 h.p. Spindle Drive

Same features and advantages as the 3 h.p. model, but powered for heavier cuts, including many moderate-sized carbide milling jobs.

**Brown & Sharpe**

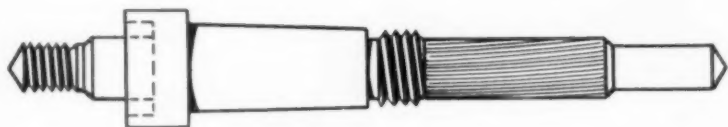


S



# PETERMANN

## A U T O M A T I C S F O R C L O S E T O L E R A N C E S



Typical part produced on a  
Petermann Automatic shown full size.

This newest member of the PETERMANN family offers new and valuable features such as six radial tools, all independently controlled; hydraulic buffer for shortening the time of return stroke, an accelerator which speeds up the cam shaft during "idle time," an automatic lubricating system and a speed box change for both spindle and cam shaft.

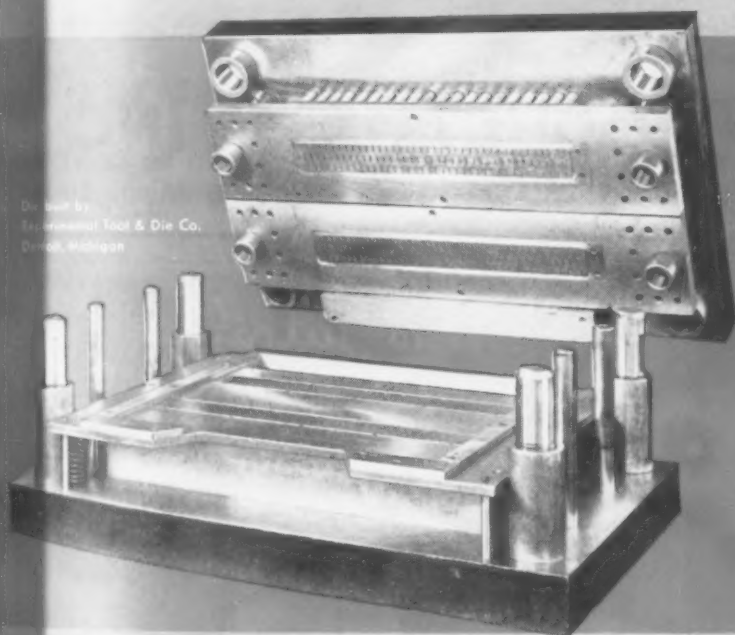
Complete service and parts in America.



**RUSSELL, HOLBROOK & HENDERSON, INC.**  
**292 MADISON AVE. • NEW YORK 17, N.Y.**

## PIECE PART REJECTIONS REDUCED

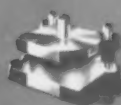
Diemakers at Experimental Tool & Die Company solved a costly repair soldering problem on these stamped radiator heads with the die shown below. Precision was the secret. Die tolerances were held to within .0001" and all die components had to be interchangeable. That's why they specified . . .



Die Set by  
Experimental Tool & Die Co.  
Detroit, Michigan



# DIEMAKERS' SUPPLIES and PRECISION DIE SETS



Die Sets



Dowel Pins



Die Springs



Cap Screws



Stripper Bolts

Diemakers everywhere depend on Danly precision. Every Danly product—die sets, dowel pins, die springs, cap screws, stripper bolts—is designed to complement the finest die work. For complete, reliable service, come to Danly!



**DANLY MACHINE SPECIALTIES, INC.**

2100 South Laramie Avenue, Chicago 50, Illinois

**CALL ON THE DANLY BRANCH**

**NEAREST TO YOU FOR FAST LOCAL SERVICE**

\*CHICAGO 50, 2100 South Laramie Avenue

\*CLEVELAND 14, 1550 East 33rd Street

\*DAYTON 7, 3196 Delphos Avenue

\*DETROIT 16, 1549 Temple Avenue

\*GRAND RAPIDS, 113 Michigan Street N.W.

INDIANAPOLIS 4, 5 West 10th Street

\*LONG ISLAND CITY 1, 47-28 37th Street

\*LOS ANGELES 54, Ducommun Metals & Supply Co.,  
4890 South Alameda

MILWAUKEE 2, 111 East Wisconsin Avenue

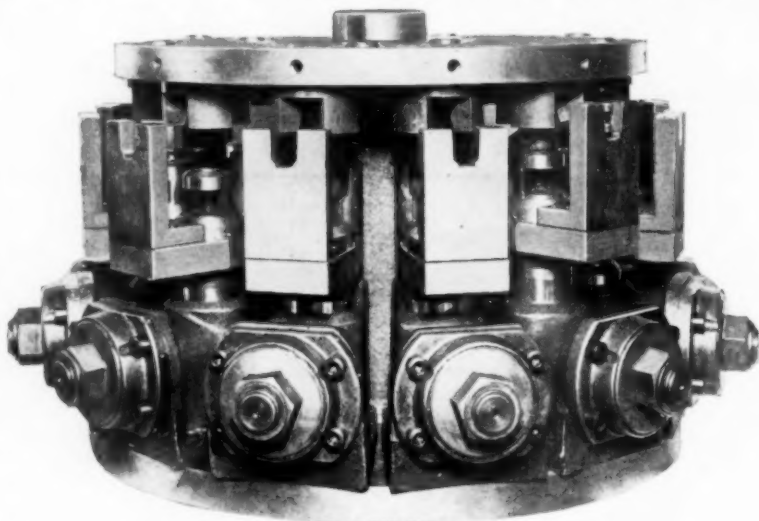
PHILADELPHIA 44, 18 West Chelton Avenue

\*ROCHESTER 4, 16 Commercial St.

\*Indicates complete stock

# REDUCE LOADING TIME WITH SWARTZ LOCKS

COMPACT, POSITIVE CLAMPING PLUS MORE PIECES PER HOUR



ALL LOCK PARTS ARE  
HARDENED AND GROUND

#### REPRESENTATIVES:

SYRACUSE  
Arthur Irvine  
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Production Tool Co.  
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R. W. Pratt  
BOSTON  
A. R. Shevlin & Co.  
TOLEDO  
Peerless Tool Service Co.  
CANADA  
Firth Brown Tools, Ltd.  
Galt, Ont.

WRITE FOR CATALOG 941

Multiple index fixture to locate and drill hole in boss of brake lever.

## SWARTZ TOOL PRODUCTS Co., Inc.

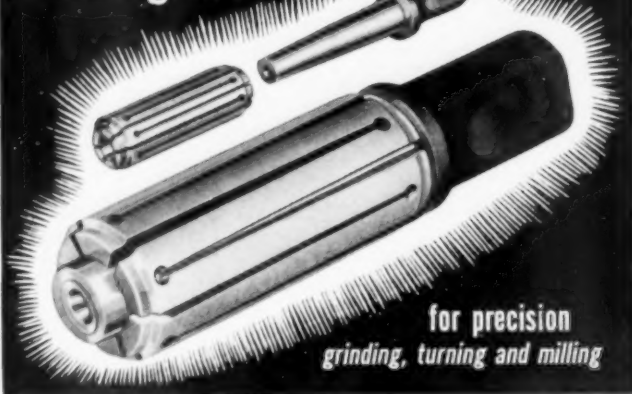
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for precision  
grinding, turning and milling

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### Precision Expanding Mandrel

Entirely new in principle, this positive drive, quick change work mandrel cuts handling time . . . guarantees concentricity . . . eliminates arbor pressing and collecting.

Lower cost production is assured with faster work, fewer rejects, less tool cost. Arbor is built for heavy loads. Sleeve closes at .003" under and opens to .007" over nominal size. Positive stop prevents overstrain. Holds tolerances of less than .0002" run out.

Standard sizes from 1/2" through 3" diameter, graduated by 1/16", fit your machine. Special sizes if required. More details on request.

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The WESTERN Tool & Mfg. Co., Springfield, Ohio

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## LOOK TO Tuthill FOR HELP ON YOUR PRESSURE LUBRICATION PROBLEMS

There's a Tuthill positive displacement pump to meet your pressure lubrication requirements *exactly*.



MODEL L is a mechanically sealed pump built in capacities up to 3 g.p.m.



MODEL R automatic reversing pump delivers from the same port, regardless of direction of shaft rotation. Capacities to 200 g.p.m.



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The Tool Engineer

# SNYDER MACHINES CONTROL COSTS

**74** Crankshafts an Hour  
at 100% Efficiency

**43** Stations  
Automatic Transfer

## Automatic Operation

Drills all oil passage  
and lightening holes



Drills and Reams  
manufacturing holes



Automatic positioning



Automatic clamping



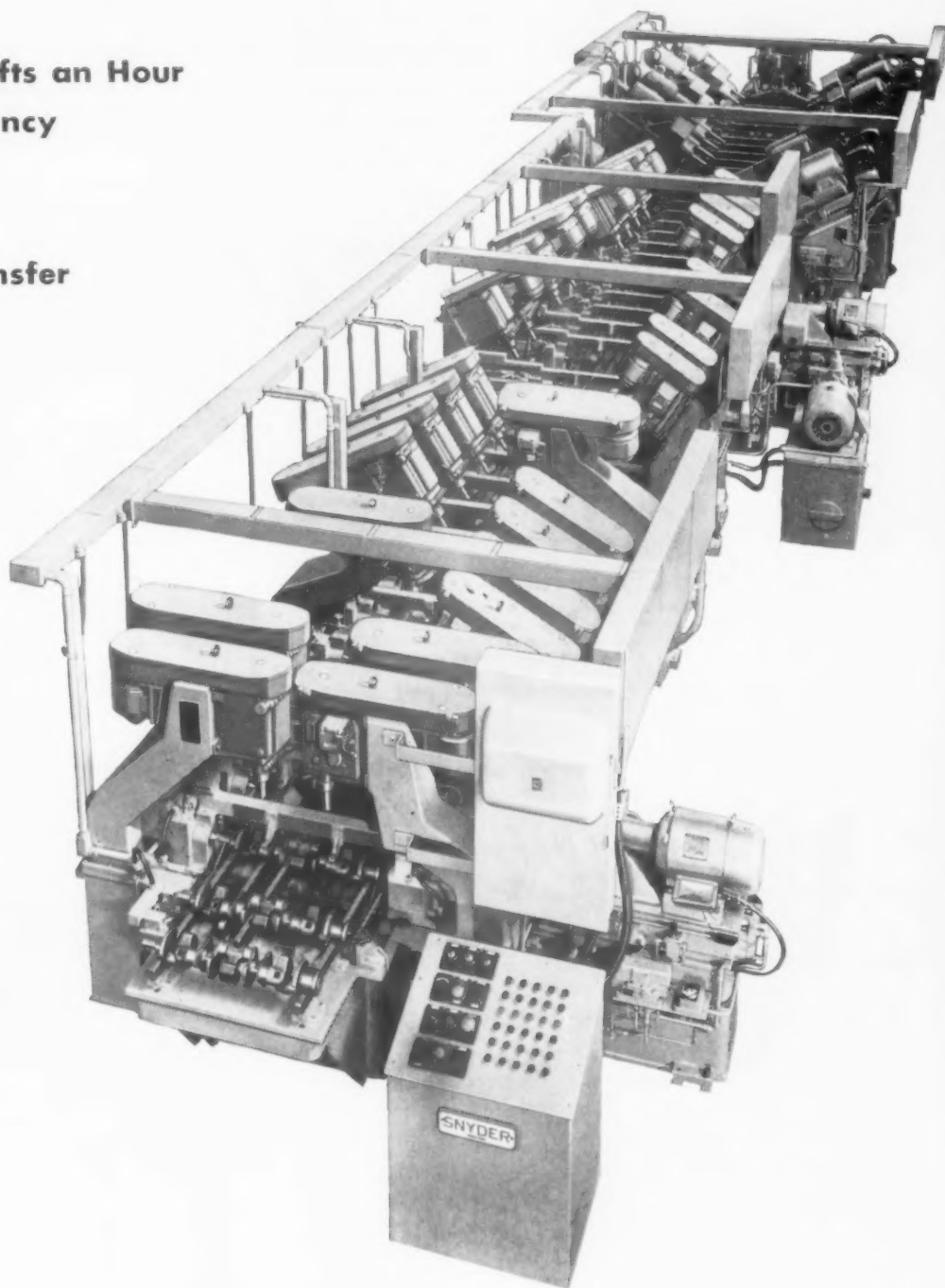
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TOOL & ENGINEERING COMPANY

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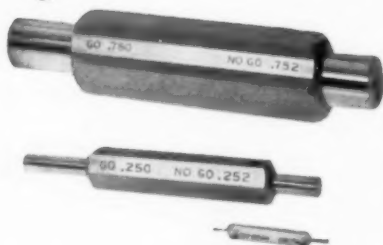
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*Van Keuren*

WIRE TYPE PLUG GAGES

Carboly  
Chromium Plate  
High Speed Steel  
Alloy Tool Steel

Full 1 7/8" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. Prompt delivery from a stock of 2 million wires.



Van Keuren Wire Type Gages are made to Class B accuracy  $\pm .00005$ "  $\pm .00000$ " on the Go units and  $\pm .000025$ " on the No Go units. Closer or wider tolerances can be supplied if desired.

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This 208 page volume represents 2 years of research sponsored by the Van Keuren Co. It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods. Comes free upon request.



THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboly Measuring Wires • Carboly Plug Gages.

32nd YEAR

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STA KOOL  
DIAMOND DRESSER

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In case after case it has been demonstrated that J. K. Smit diamond tools do have longer, more productive life.

## Why?

Because, sixty-three years of experience in handling Industrial Diamonds has aided in developing Diamond Tools to their present high degree of utility. This improved Tool performance means economy.

Because of their experience, our field engineers have been called upon to solve many of industry's industrial diamond problems. Consider this, when you have problems where a J. K. Smit Engineer can be of help.

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our nearest office for prompt attention.

**J. K. SMIT & SONS**  
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J. K. SMIT & SONS of CANADA

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18,000 RPM



**"SPEE-DEE" Pneumatic POLISHER**

A development filling a distinct need. Produces remarkable results on real production work when abrasive rolls and pencils, also bands, etc., are used. Flexible air-control lever for starting and stopping. Husky, light weight, 14 oz. Power to spare. Special grease-sealed bearings. Will handle many applications, also with "High-Speed" Rotary Files.

ALSO "M-B" PNEUMATIC GRINDERS—AUTOMATIC AIR LINE FILTERS, REGULATORS AND LUBRICATORS

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Representatives in  
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MORE THAN 4 OUT OF 5 USE

**RUTHMAN GUSHER**

Machine Tool Coolant Pump



There's a good reason why four out of five of the leading manufacturers of metal-cutting equipment regularly supply Gusher Coolant Pumps on their machines. They know from experience that Gusher Pumps are more dependable and longer lasting. Gusher Pumps are built by Ruthman, designers and originators of the vertical motorized machine tool coolant pump and their skill and experience is continually directed toward giving you a better, more advanced coolant pump. Follow the leaders—specify Gusher Coolant Pumps on your machines.

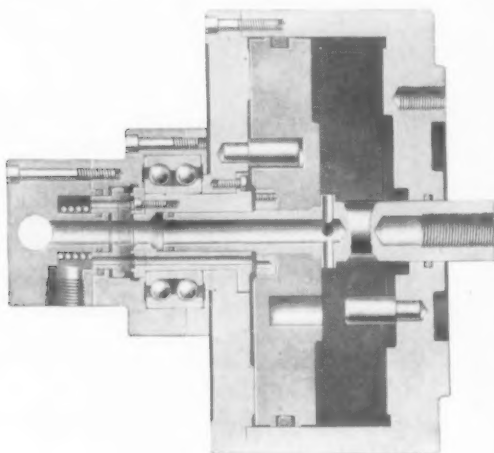
**THE RUTHMAN MACHINERY CO.**  
1810 Reading Rd., Cincinnati, Ohio

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## The New **CUSHMAN** Iron body Air Cylinders



**SIMPLE, RUGGED, PRECISION-BUILT UNITS  
YOU CAN INSTALL ON YOUR PRODUCTION LINE AND FORGET**



These new iron body air cylinders follow the well-proved design of our very successful high speed aluminum body cylinders. They are suitable for operating either Cushman Air Chucks or those of other makes. Note these important features:—

Cylinder Body is one piece casting, light in weight, yet ample in section. Bore is precision lapped and piston fitted with special "O" ring seal. In addition, operation is protected by a graphitar disc air seal (patent applied for) that is pressure balanced under load. You will have no trouble with air pressure leakage under heaviest recommended production loads.

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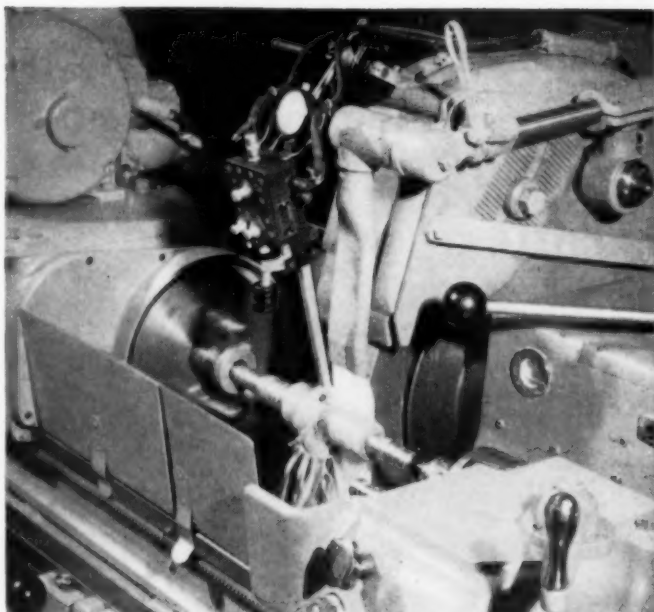
Write for bulletin No. PO-8. And please anticipate your needs, since deliveries are tightly scheduled.

**THE CUSHMAN CHUCK COMPANY, HARTFORD 2, CONNECTICUT**

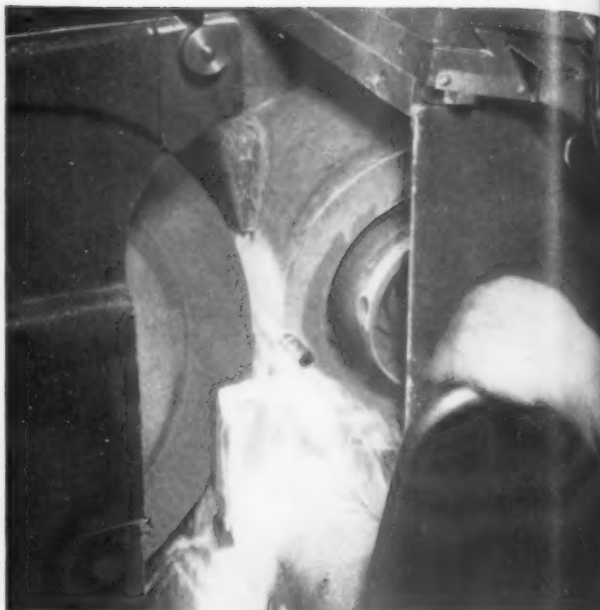
# CUSHMAN

*A World Standard for Precision*

# CHUCKS



**CYLINDRICAL GRINDING COSTS GO DOWN** when you take full advantage of the uniform, free-cutting performance and extra long life of Norton vitrified bonded ALUNDUM® wheels. Test them and see how much they improve your operations.



**LOW-COST CENTERLESS GRINDING** comes naturally with Norton wheels. For example, you can't beat wheels of fast-cutting CRYSTOLON® abrasive for cast iron and those of the non-ferrous metals which have low tensile strength.

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**CYLINDRICAL OR CENTERLESS . . .** your exact grinding wheel specifications are covered by the Norton line . . . most complete in the abrasive field. No other line gives you such assurance of getting the right wheel for any job.

**when you pinpoint your specifications with Norton Grinding Wheels!**

There's *only one* wheel that's *just right* for a particular O.D. grinding job. Any other wheel loses money for you.

You'll find the right cost-cutting wheel in the *complete* Norton line of cylindrical and centerless grinding wheels. How can you miss? You have a wide choice of cool-cutting, long-lasting wheels in ALUNDUM and CRYSTOLON abrasives in a number of bonds . . . in a great variety of grains, grades, and structures. And once you've found the right Norton wheel, you'll be sure of uniform results from wheel to wheel. No other wheels match Norton uniformity.

**GET THE FACTS!** Your nearby Norton distributor or representative will gladly help you select cost-cutting Norton wheels. In the meanwhile, write for the 40-page booklet "The ABC of O.D. Grinding" (Form 2006). NORTON COMPANY, Worcester 6, Massachusetts. Distributors in all principal cities.

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**NORTON**  
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*Making better products to make other products better*

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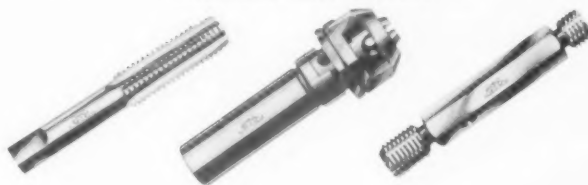
## Why Greenfield?

At "Greenfield," nothing is left to chance, nothing is taken for granted. Attention is given to every detail — to insure a product as near perfect as modern engineering skill can make it.

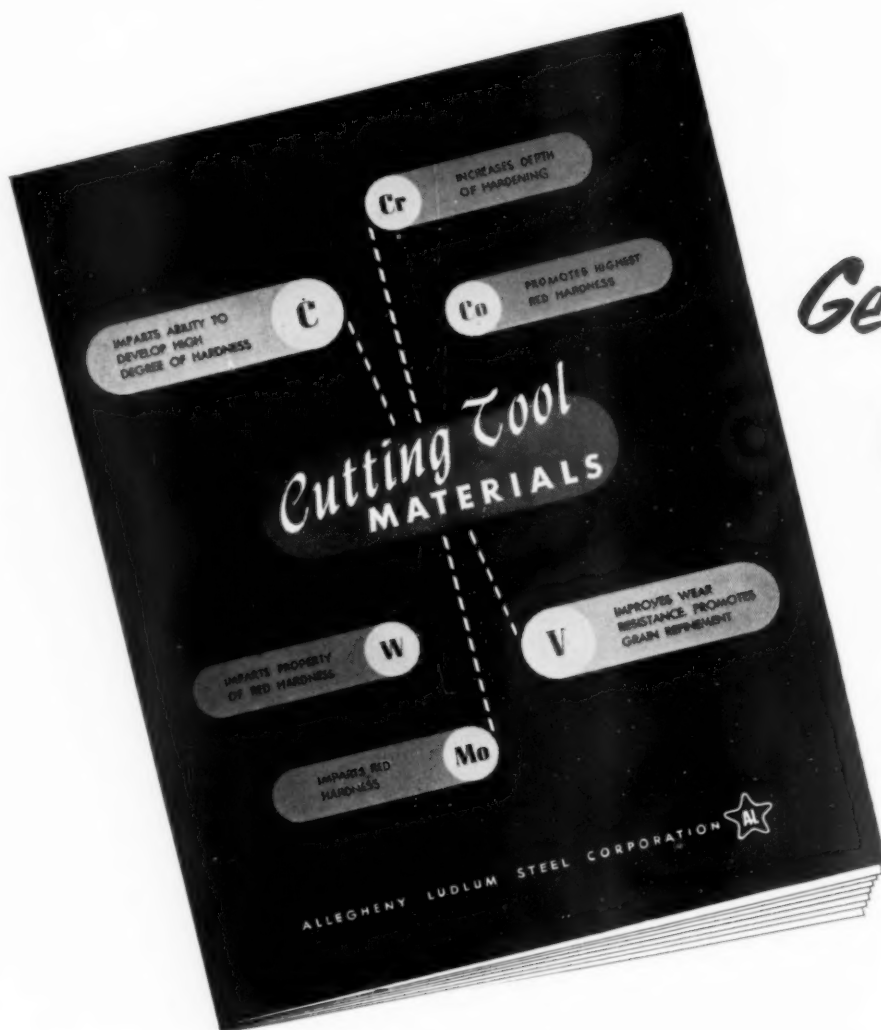
Take tap chamfering. At "Greenfield," skilled operators working at specially designed automatic chamfering machines turn out taps which exceed all previous standards of perfection. Correct angle, concentricity, and length of chamfer in a tap insure a good tapping job for

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**GREENFIELD TAP AND DIE CORPORATION**  
Greenfield, Massachusetts



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when you're *puzzled about Tool Materials!*

**A-L OFFERS YOU  
Complete Service  
for Modern Tooling**

By "complete" is meant that Allegheny Ludlum produces the full range of modern cutting tool materials, hence is in position to know and recommend the type best suited for any stated purpose. Unbiased content makes the 8½" x 11" booklet, shown, all the more valuable. Specify its title, "Cutting Tool Materials."

ADDRESS DEPT. TE-19

You should have a personal copy of this 36-page booklet close at hand, if you are continually running into new cutting problems. Use it as a guide to quick answers to scores of possible questions such as:

"Should we use *Carbide* on this job? What grade?" . . . or, "How about tooling up with *Cast Alloy* for that other run?" . . . or, "Can we cut this extra-tough stock fast enough with our usual grade of *High Speed Steel*?"

This booklet in no way replaces, but does supplement, what you can learn by practical experience or what you can gain by calling in an A-L tool engineer. In compact form and quite impartially, the booklet presents the basic facts that enable you to speedily compare the suitability of various tool materials for specific uses. *Send today for your free copy.* There is no obligation involved.

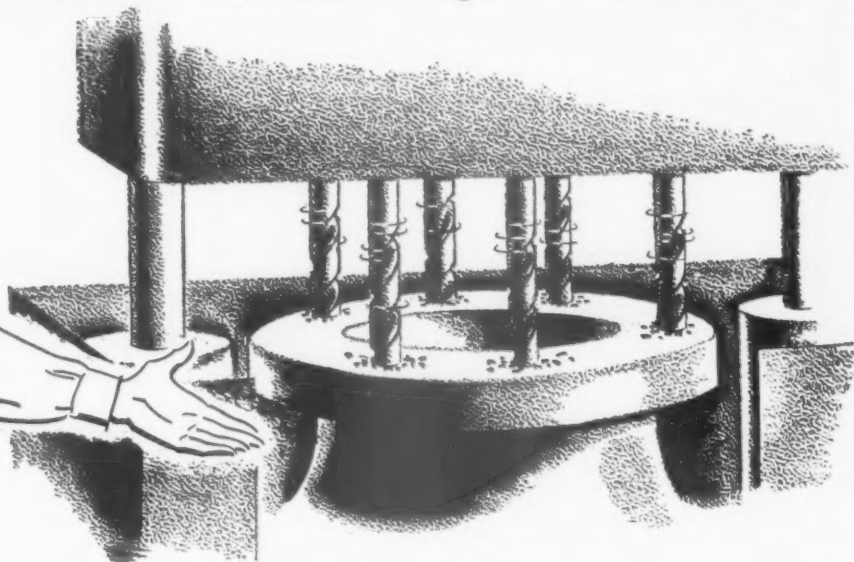
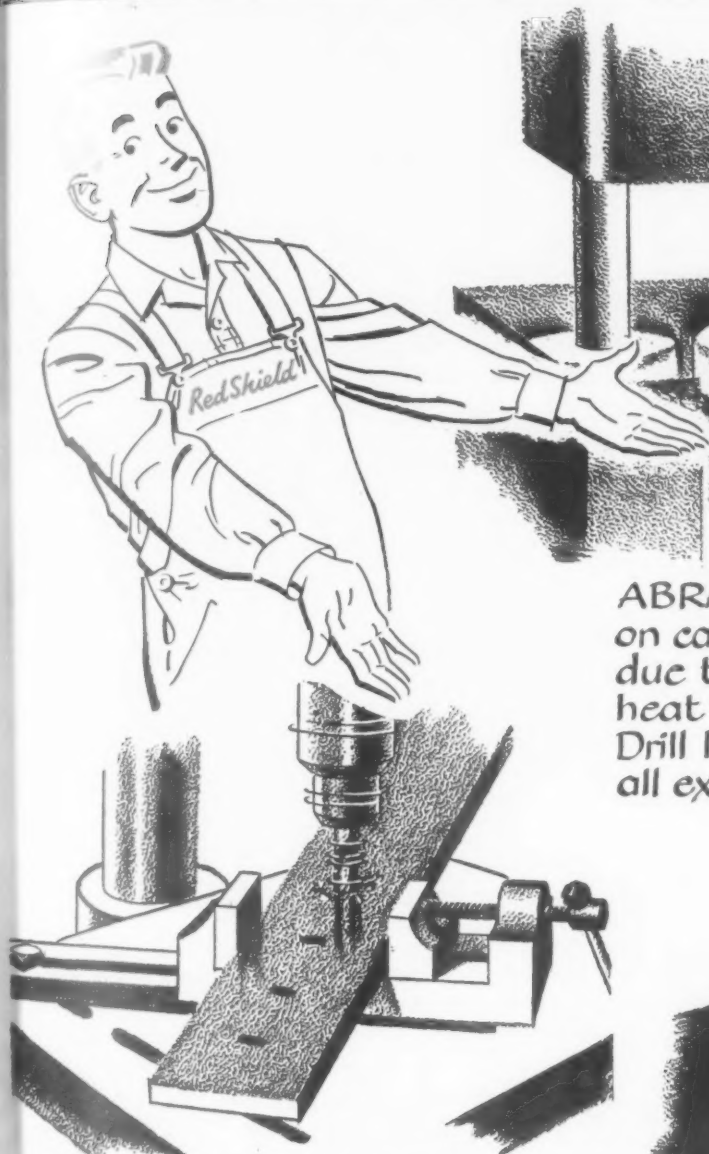
• Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

For complete **MODERN** Tooling, call  
**Allegheny Ludlum**

W&O 3703



# DRILLING POINTERS..... *by Red Shield*



**ABRASION.**  $\frac{1}{16}$ " taper shank drills on cast iron valve job were wearing due to abrasion. Changed surface heat treatment to suit their problem. Drill life increased beyond all expectations.

**STAINLESS.** Regular drills averaged 3 holes per grind in tough work-hardening stainless steel. We suggested No. 506 F Fast Spiral Drill with special heat treatment and point. ...Now get more than 90 holes per grind.



**SERVICE.** 70 years' experience behind our Red Shield Service Staff...to help solve your metal cutting problems. Get in touch with your local Standard Tool Co. distributor.

## STANDARD TOOL Co.

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CLEVELAND 14, OHIO



New York • Detroit • Chicago • San Francisco

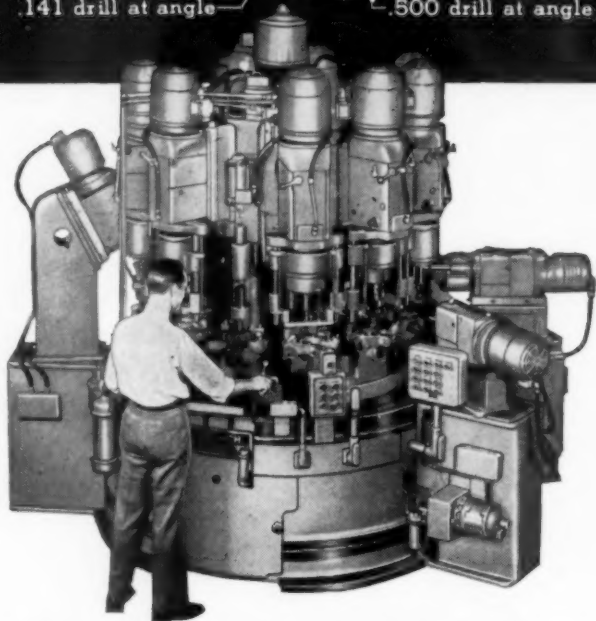
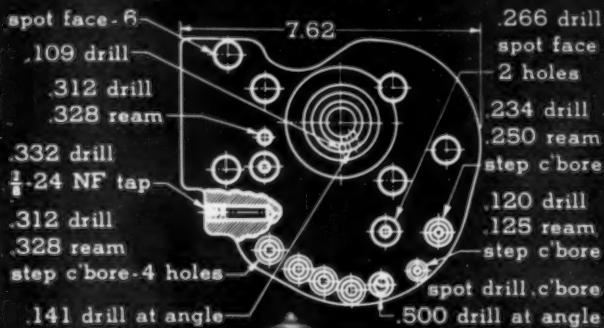
THE STANDARD LINE: Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools

July, 1951

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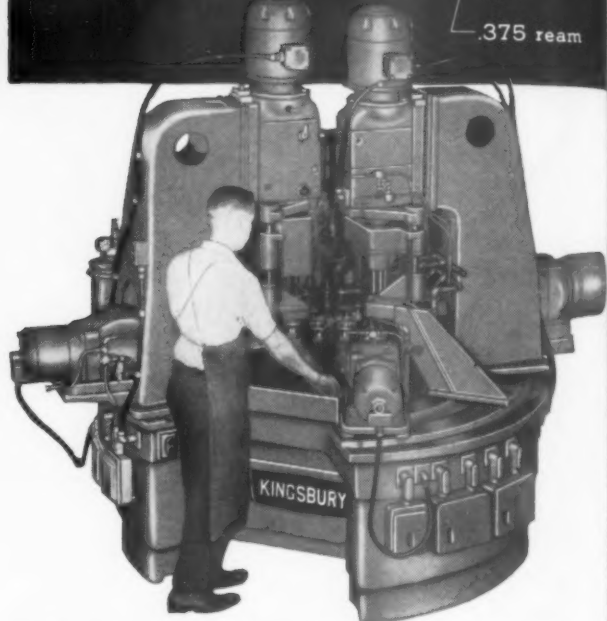
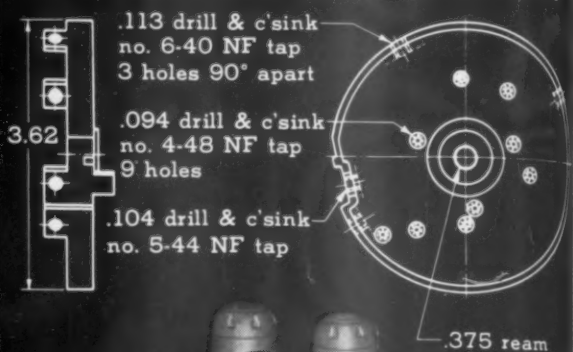
121

## Transmission part $7\frac{7}{10}$ ¢ per part for 33 operations from 4 directions



**185 PARTS AN HOUR GROSS.** This 60-inch power indexing machine has 12 stations. Eight vertical units mounted on the central column operate 28 tools. Two angular units drill .141 and .500. Two horizontal units drill .109 and .332 and tap  $\frac{1}{4}$ -24.

## Telephone part $8\frac{8}{10}$ ¢ per part for 27 operations from 5 directions



**970 PARTS AN HOUR GROSS.** Twelve fixtures on a 20-inch power index table rotate 120° with each index. Four horizontal units drill and tap the peripheral holes. Three vertical units do the ten axial holes. Clamping and unclamping are automatic.

# Amazingly low unit costs

**Any way you figure it, Kingsbury machines save money on accurate high-production drilling and tapping operations**

Dear Sir:

Here is the average cost of the man and machine for each operation shown in the drawings:

Transmission part	22/100¢
Telephone part	3/100¢
Generator part	7/100¢
Typewriter part	10/100¢

One reason these costs look good is that they include just the man and machine — no power or overhead. But there is no tricky figuring. In fact, we think the basis is quite conservative. We assumed:

- 1) 80% efficiency;

- 2) a wage rate equal to today's national average;

- 3) a pay-off period of 6000 hours of production — about a year with three shifts or three years with one shift, a fraction of the useful life.

The unit cost on each drawing is the sum of these two figures —

The unit cost of the man:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross} \times 80\% \text{ efficiency}}$$

The unit cost of the machine:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hours @ 80\% efficiency}}$$

**You can use actual figures**

We hold no brief for our assumptions, but we had to assume *something*. The pay-off period is 6000 hours because most Kingsburys do pay for themselves in one to three years.

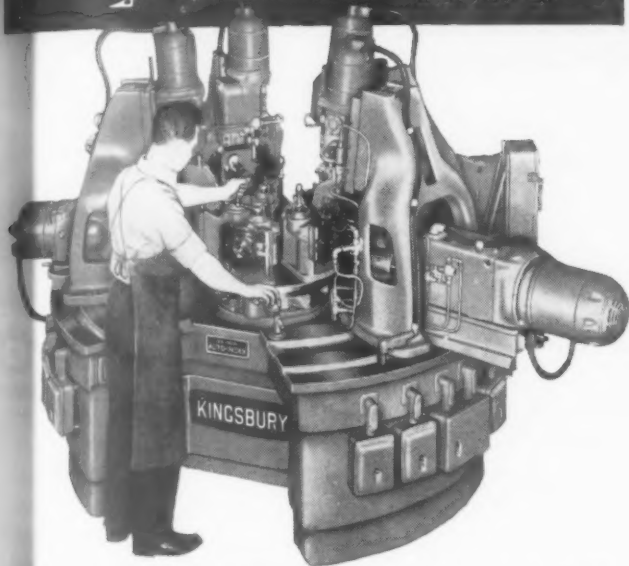
If you want to know if a Kingsbury would be a good investment for you, ask us for a proposal. Then figure your unit costs in your own way using your own figures. Even a rough calculation may convince you.

**Meeting close tolerances**

Savings alone don't sell Kingsburys. Other high production machines may match our costs. But how about the quality of the finished parts? In all

## Generator part for 19 operations from 2 directions

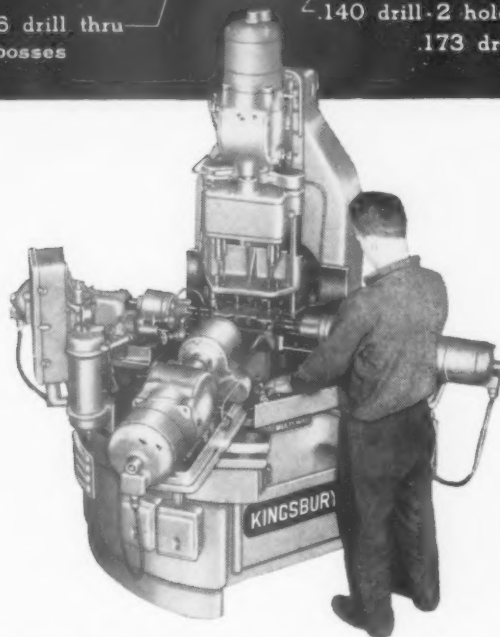
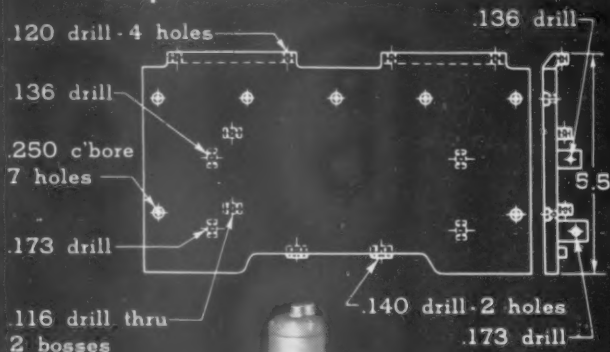
1 $\frac{3}{10}$ ¢ per part



430 PARTS AN HOUR GROSS. A 20-inch power index table has five fixtures. At the four working stations four horizontal units do the holes in the left view and four units on tunnel columns do the oil hole. Three units have multi-spindle heads.

## Typewriter part for 18 operations from 5 directions

1 $\frac{7}{10}$ ¢ per part



280 PARTS AN HOUR GROSS. Put one piece in the fixture and trip a lever. The vertical unit clamps it and counterbores seven holes. Then horizontal units operate on four sides. When the clamp withdraws, remove the piece. There is no indexing.

# on 4 high production jobs

humility we feel that in this type of work no equipment excels ours. That is just our opinion, of course, but it is an honest one.

Bushings guide drills and reamers accurately. We locate spindles to exact indicator readings and run them in precision ball bearings.

Each index table and its fixtures are jig-bored to minimum tool room tolerances. Each fixture is rugged and grips the part firmly without distortion. The locating points conform to your specifications.

### We're not in the back woods

Some people who visit us for the first time are surprised at the quality of our equipment and our work.

Maybe they just don't expect much from people in the New Hampshire hills. Actually we are right between the machine tool centers of Worcester, Mass. and Springfield, Vt.

Our shop has three acres of floor space, 122 machines under ten years old and employs 316 people with a combined length of service of 3257 years. We have 11 jig-borers and nine boring machines, mostly in a

windowless air-conditioned building with strict control of temperature and humidity.

If you are ever up in these parts and have high production drilling and tapping problems, we hope you will stop in and see us. We make a lot of friends that way.

Sincerely,

Kingsbury Machine Tool Corp.  
95 Laurel St., Keene, N. H.

# KINGSBURY

**AUTOMATIC DRILLING  
& TAPPING MACHINES**  
for Low-Cost High Production

July, 1951

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123

# NEW HAUSER

# BURNISHING METHOD

Faster and More Accurate Than Any Other Lapping, Grinding or Polishing Method Known

NOW AVAILABLE FROM U.S. STOCKS

## HAUSER

Type 241 Pivot Polishing Machine for Wet Polishing — 600 or More Pivots Per Hour

REPLACES CENTERLESS GRINDING

### FEATURES:

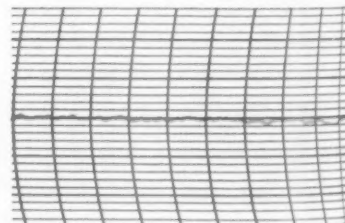
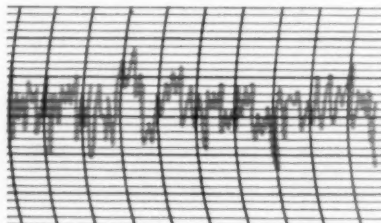
- Polishes to 0.2 to 0.3 micro-inch R.M.S.
- High precision — Simple operation
- Low Cost Polishing
- Polishing range: Min. dia. 0.008"
- Max. dia. 0.197" Length to 0.315"
- Workpiece length to 5"
- Polishes straight, taper or radius
- Polishes shoulder at same time as cylinders at right angle or bevel as desired
- Polishes wide range of metals
- Takes work in collets or between centers
- Long life carbide or ceramic wheels
- Can be equipped with production-run time switch

Factory Service and Parts are available from Manhasset, N.Y.

### ANALYZING CHART

BEFORE BURNISHING

AFTER BURNISHING



Magnification: 40,000 vertical — 88 horizontal



#### HAUSER TYPE 241

Pivot Polishing Machine can be supplied with or without base, as desired.

## HAUSER

MACHINE TOOL CORP.  
AFFILIATED WITH  
CARL HIRSCHMANN CO.

30 Park Avenue, Manhasset, N.Y. • Representatives in Principal Cities



Sole U. S. agents for Henri Hauser Ltd., Bienne, Switzerland — Jig Bore, Jig Grinders, Optical Measuring Machines, Profile Projectors, Burnishing Machines



At 30 Park Avenue, Manhasset, N. Y., is the widest selection of Swiss precision machine tools available from any one address in the United States. Represented here, in addition to Henri Hauser, Ltd., are Tornas Works, Ltd.; Schaublin, S. A.; S. Lambert, S. A.; Safag, S. A.; and Agathon, Ltd., which are handled exclusively by Carl Hirschmann Company.

# SWISS PRECISION CRAFTSMANSHIP SWISS DEPENDABILITY ACCURACY

Regardless of...



1. Food Grinder Screw
2. Cylinder Head
3. Milling Cutter Body
4. Valve Seat
5. High Pressure Pump Body

You can  
depend on  
**MEEHANITE**  
Engineering  
Properties!

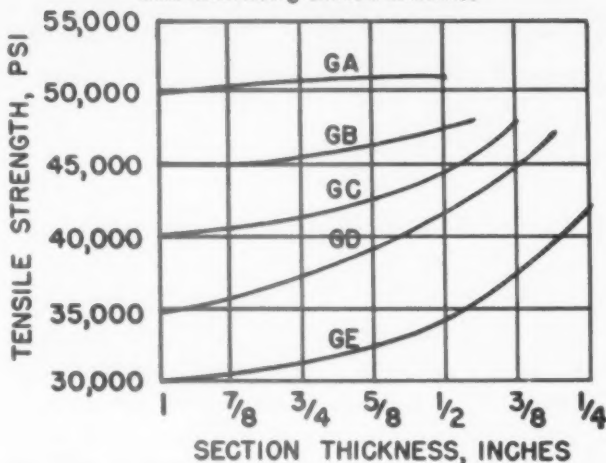
**SIZE, SHAPE, or WEIGHT**

The group of small lightweight Meehanite castings illustrated are typical of both the variety and importance of thousands of similar small casting specifications regularly met by many Meehanite foundries. While giant, heavy weight castings are spectacular and, of course, important too, many a vital component of important equipment lies hidden;—those small parts weighing from a few ounces to a few pounds yet whose properties and qualities must be both exact and uniformly superior.

Meehanite castings large or small are manufactured using definite and established process controls. These controls permit the regular meeting of property specification such as strength, hardness, modulus of elasticity or resistance to wear, heat and corrosion, according to the combination of characteristics required.

These same property controls aid in the ability to minimize mass influence as revealed in the chart shown.

Graph showing change in tensile strength with decreasing section thickness



**WHEN YOU NEED "EXTRAS" IN QUALITY OR PROPERTIES  
CONSULT ANY OF THE FOUNDRIES LISTED BELOW**

American Brake Shoe Co.	Mahwah, New Jersey
The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
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Builders Iron Foundry	Providence, Rhode Island
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Valley Iron Works, Inc.	St. Paul, Minnesota
Vulcan Foundry Co.	Oakland, California
Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

"This advertisement sponsored by foundries listed above."

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NEW ROCHELLE, N. Y.

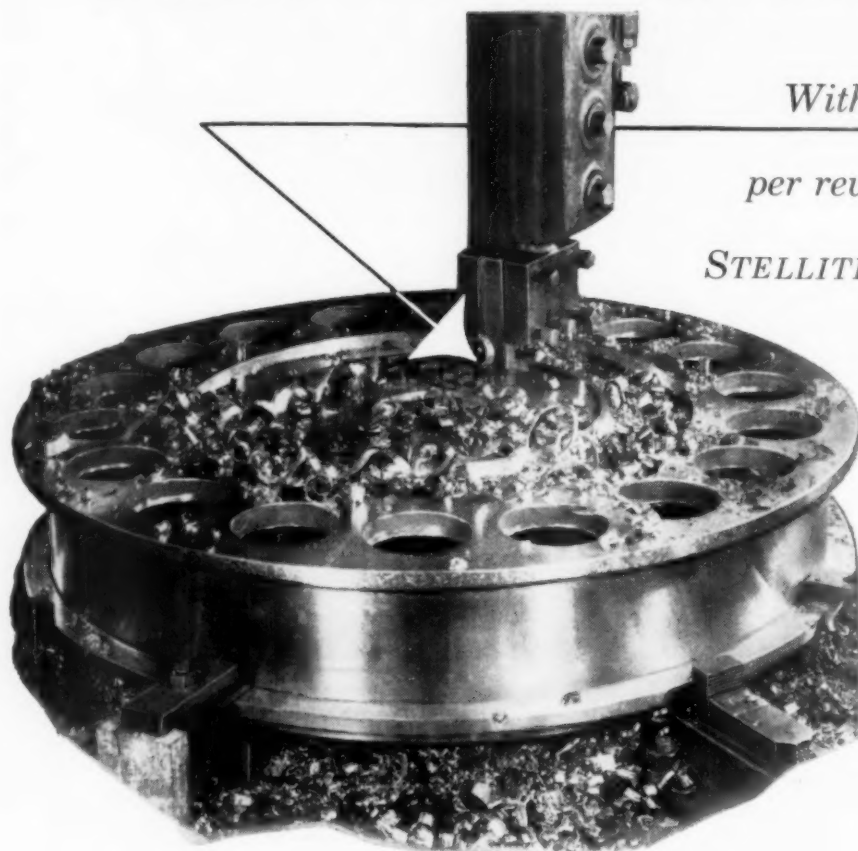
ly, 1951

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-125

125

# Fast Machining of Stainless Steel

**DESPITE A HEAVY INTERMITTENT CUT**



*With 18 interrupted cuts  
per revolution, HAYNES*

*STELLITE tools removed almost  
20 cubic inches of  
metal per minute  
from this  
STAINLESS  
STEEL  
CASTING.*

Making 12 to 16 intermittent cuts per minute on an 18-8 stainless steel casting is a tough assignment for any tool. In fact, tests made by one plant showed that only HAYNES STELLITE tools could handle such a job. The operation consisted of machining the entire face of 54-in. diameter castings that had Brinell hardness ratings of from 180 to 200. There were 18 holes, 6 inches in diameter, just inside the circumference of the castings. The impact of the intermittent cutting caused other tools to chip and spall before they progressed beyond this critical area.

Because HAYNES STELLITE tools have good impact properties, combined with excellent red hardness and compressive strength, the facing operation was speeded

up. Cutting speed was 100 surface ft. per minute, and a lubricant was used. The depth of cut averaged  $\frac{1}{8}$  in. and the feed was  $\frac{1}{16}$  in. per revolution. Because of the severe impact conditions, no rake or cutting-edge angle were ground in the tools, but they were given a  $\frac{1}{16}$  in. nose radius. One to two pieces per grind was the average tool life.

If you would like information on how you can speed up many machining operations despite difficult operating conditions, write or phone the nearest Haynes Stellite District Office. Ask for a copy of the booklet "Operating Information on HAYNES STELLITE 98M2 Cobalt-Chromium-Tungsten Alloy Turning and Boring Tools and Milling Cutters."

## HAYNES

TRADE-MARK

*alloys*

**Haynes Stellite Company**

A Division of

Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago — Cleveland — Detroit — Houston

Los Angeles — New York — San Francisco — Tulsa

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.



# **Checkmate** **RIISING COSTS!** **...WITH SPECIAL** **CUTTING TOOLS FROM** **NATIONAL TOOL CO.**

CLEVELAND 2, OHIO  
 REPRESENTATIVES IN MAJOR INDUSTRIAL CENTERS



July, 1951

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-127

127

# ...of Special Interest to **HOLE** Engineers



## HOW AIRFEEDRILL\* BROKE A PRODUCTION BOTTLENECK

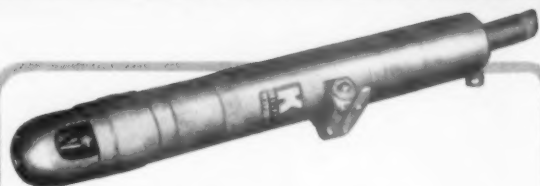
In producing this small part, a drilling operation kept one worker busy full time. Her output set the pace for the entire production line... placed a top limit on output per hour and per day.

The job didn't warrant an extra drill press and operator, so the ingenious shop foreman set up a simple mounting and fixture with a Keller Airfeedrill.\*

Now by pressing a valve, holes are drilled as fast as the operator can load and unload the fixture. Castings pass this operation so fast that the worker has time to do other jobs, too. Production of the whole line has increased, and costs have gone down accordingly.

The Airfeedrill can help you speed output of short run or production drilling jobs. A Keller sales engineer will gladly discuss it with you.

\* Keller Tool Company Trade Mark



- Assures accurate holes without costly fixtures... can be used with existing jigs
- Attaches in any position and supports itself at any angle
- Operates and is controlled entirely by air... with pneumatic cycling to speed production, reduce operator fatigue
- Small size permits it to be used on close centers and in tight places
- Accurately drills parts too large for conventional drilling machinery
- Wide range of speeds and strokes will accommodate light or heavy metal, wood, composition, plastic
- Lightweight portable and stationary models are readily adapted to changing job requirements... quickly shifted from job to job

KELLER TOOL COMPANY  
GRAND HAVEN, MICH.



**KELLER** *Pneumatic Tools*

# *First & Finest!*

## Jones & Lamson Radial Chaser Die Heads

**GROUND  
with THREAD  
CHASERS**

These Die Heads will do an outstanding job on large or small lots, in pitches ranging from extremely fine to coarse multiple Acme.

They are versatile tools with an over-all capacity of from No. 8 to 4 1/4".

They require no more than the proper chasers to cut either right- or left-hand threads. No extra equipment is needed.

They are easy to install and simple to handle. For almost half a century J&L Dies and Chasers have been the answer to a multitude of threading jobs throughout the world.



Look at these features that make them leaders in their field and give you better threads at lower cost:

### **STRENGTH**

Every part is of solid steel, hardened and precision ground. There are no built-up sections. Dependability and ultimate capacity are assured.

### **FLOAT**

All models are built with both concentric and longitudinal float.

### **DUAL-DIAMETER CONTROL LEVER FOR ROUGHING AND FINISHING CUTS**

Heavy rough cuts, followed by light, accurate finish cuts can be taken with the same set of chasers by merely moving the roughing attachment lever. This is often a chaser saver on heavy, coarse pitch jobs, especially where short chamfers are a requirement.

### **SIZE ADJUSTMENT**

The external micrometer adjusting screw provides simple and precise setting to exact pitch diameter. It is easy to set and maintain sizes well within your thread tolerances.

### **RAPID CHASER CHANGE-OVER**

Chasers are removed for resharpener, or size replacement, by merely removing the front cover of the Die. No tools are required. Change-over is a matter of seconds — which means more hours available for production.

Write to Dept. 710 for illustrated catalog and complete information.

*Thread Tool Division*

**JONES &  
LAMSON**



MACHINE COMPANY  
Springfield, Vermont, U.S.A.

**Machine Tool Craftsmen Since 1835**



# BAKER

MEANS **Versatility...**  
**INCREASED Productivity...**  
In Standard Drilling Machine

**BAKER MODEL 217 HEAVY DUTY DRILL** provides a selection of spindle speeds and feeds secured through pick-off gears. Machine can be adapted to heavy duty single spindle drilling, counterboring, boring, facing, forming or tapping operations and to multiple spindle operations using multiple spindle heads.

**TWO-PIECE VERTICAL FRAME DESIGN** gives increased flexibility allowing use of spacer blocks between lower and upper frames to give increased clearance from ends of spindles to top of table.

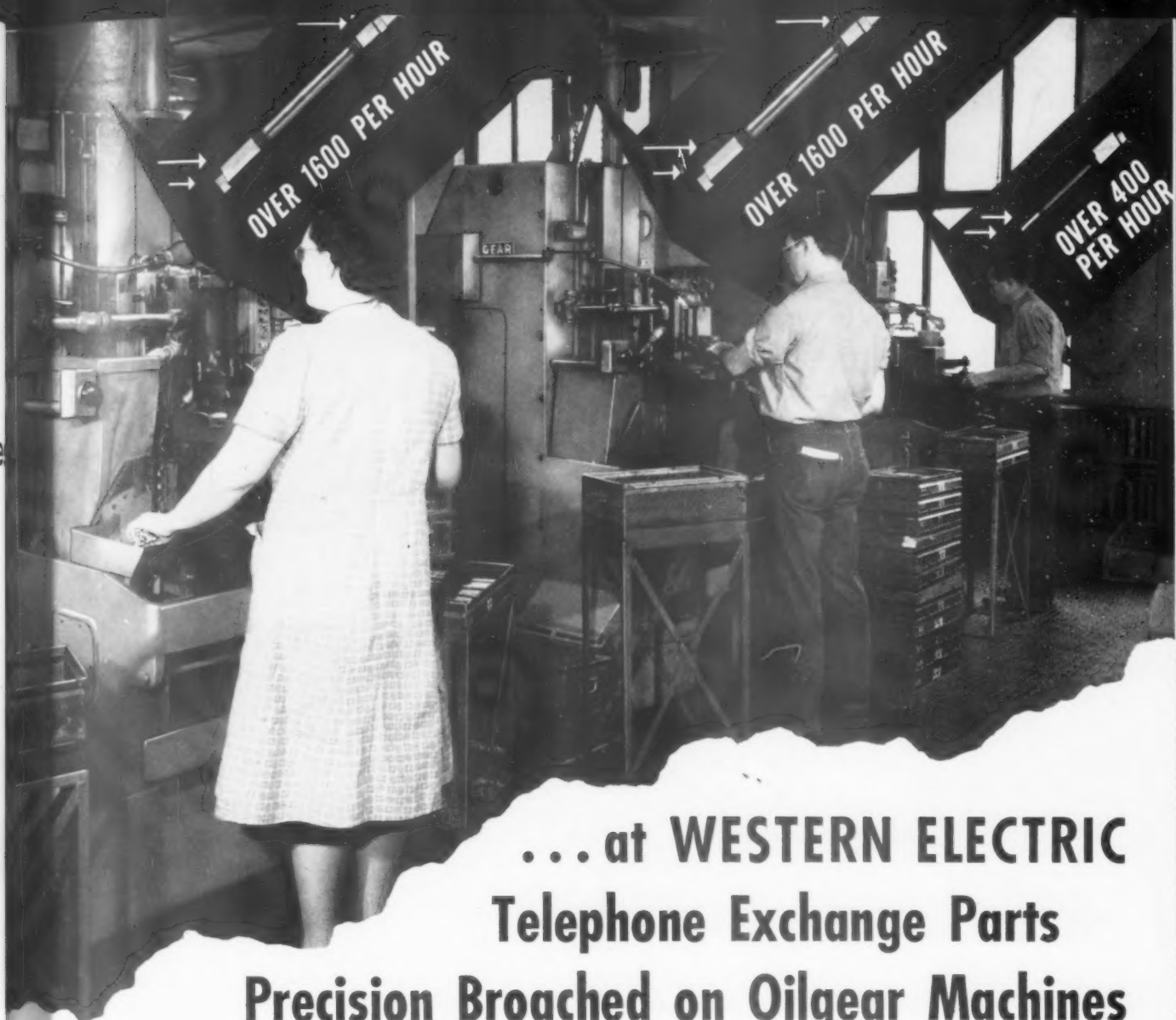
**SPEEDS.** Standard machine spindle speed range is from 76 RPM to 614 RPM. For heavier boring or facing operations the machine can be furnished with slow speed top driving gears, giving a spindle speed range of from 27 RPM to 220 RPM. To secure slower speed range, only a top driving gear change is necessary.

Write **BAKER** for full information on Standard Baker Drills.

SINCE 1867

**BAKER BROS. INC., TOLEDO, OHIO**

DRILLING . . . TAPPING . . . KEYSEATING . . . CONTOUR GRINDING MACHINES



## ... at WESTERN ELECTRIC Telephone Exchange Parts Precision Broached on Oilgear Machines

■ Oilgear Broaching Machines have been used by the Western Electric Company plants for many years . . . in some cases as far back as 1928. This great telephone and communications equipment manufacturer uses Oilgear Horizontal and Vertical Broaching Machines for finishing many delicate precision parts that go into telephone exchange assemblies.

In the scene above, three Oilgear single slide vertical surface broaching machines are used to finish various types of magnetic core pins. The first two machines finish broach two flats and a groove on 4 pins per cycle. Production on each machine is in excess of 1600 pieces per hour. The third machine broaches on each pass four 23/32" flats which have been butt-welded to round pole pieces. Production is better than 400 pieces per hour.

Oilgear Broaching Machines have many features which are available only on Oilgear Machines at no extra cost.

Here are some of these features. Oilgear two-way reverse flow variable delivery pumps have an efficiency of 90% at full load. You get higher, independently adjustable, cutting and return speeds, and positive broaching speed up to 150% overload. The patented electro-hydraulic control is integral with the pump and eliminates valves and piping. Power is saved because power is used only in proportion to the load . . . because power is reclaimed on return stroke . . . because there are no valves to waste power. The Oilgear system is a simple system. It uses less piping, is accessible yet compact. Wider slides and tables on Oilgear Machines allow broaching of 2 or more parts per cycle. Oilgear also has longer tool slides, and longer ways. Pre-loaded work tables offer closer broaching tolerances and smooth, harmonic operation. For further information, write: THE OILGEAR COMPANY, 1573 W. Pierce St., Milwaukee 4, Wisconsin.

# Oilgear

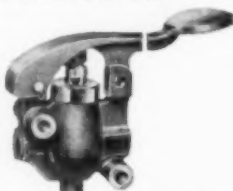
**PIONEERS IN  
FLUID POWER**

**BROACHING MACHINES AND PRESSES**

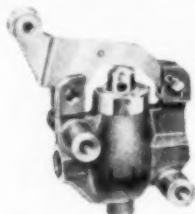


## Schrader Valves— Practical answers to air control problems

To meet the vast and increasing variety of applications for air cylinders and other air line accessories, Schrader supplies a comprehensive range of equally useful control and operating valves for operation by hand, foot or cam. Shown below are just a few from Schrader's more than a hundred models.



**Hand Lever**—This is one of the many Schrader hand operated valves. Brass body with stainless steel parts. Can be mounted rigidly at any angle. Specially constructed lever makes operation easy and



**Valves with roller lever**—These valves are designed for any cam actuation. The free turning roller riding on a cam provides long life by reducing friction.



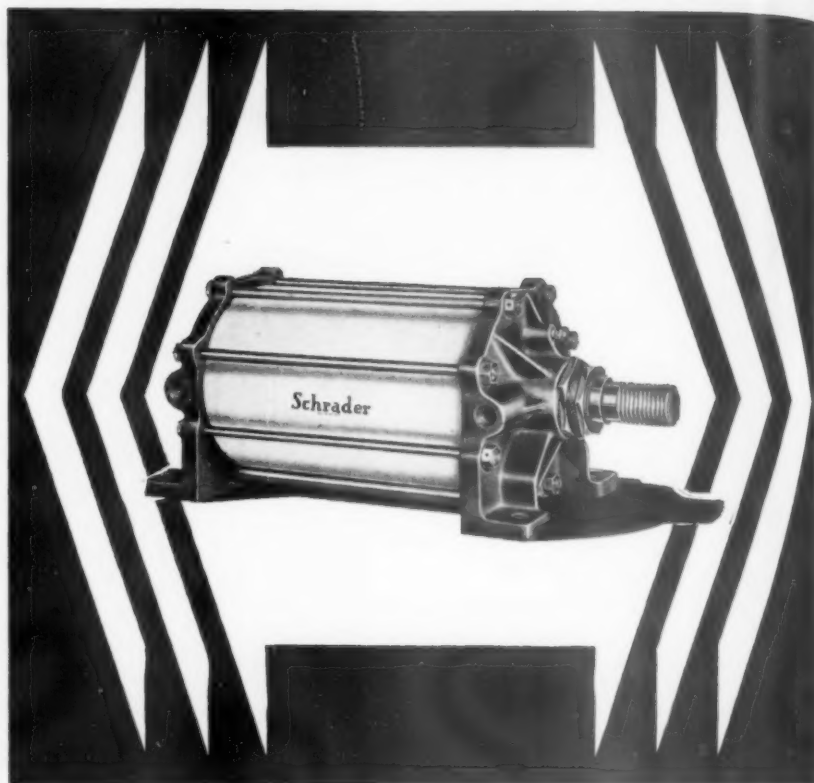
**Pilot valves**—Both two and three way, with or without timer. Normally open or normally closed. Provides instant power at remote points.



**Foot Lever**—This valve supplies line pressure to single acting cylinders. It is functionally designed for "tip-toe" operation.

Air Cylinders • Operating Valves •  
Press & Shear Controls • Air Ejection  
Sets • Blow Guns • Air Line  
Couplers • Air Hose & Fittings •  
Hose Reels • Pressure Regulators &  
Oilers • Air Strainers • Hydraulic  
Gauges • Uniflare Tube Fittings

**Schrader**  
PRODUCTS  
CONTROL THE AIR



## Four ways that air cylinders can increase production in your plant

You can make hard work easy, eliminate manual effort and speed up production by the application of air power... often the best, usually the economical way to apply force where you need it. For example:

- *To provide a powerful push*
- *Where clamping is necessary*
- *For lifting operations*
- *To power a reciprocating motion*

Schrader Air Cylinders are increasing production through safer, faster and less fatiguing operations, in many thousands of applications in plants throughout the country.

Undoubtedly there are many places in your own plant where Schrader Air Cylinders will be just the thing. Ask us to help you determine what will best fit your needs. Send us a letter outlining your particular requirements, your idea, or fill out the coupon below.

### Mail This Coupon Today

A. Schrader's Son  
Division of Scovill Manufacturing Company, Incorporated  
462 Vanderbilt Avenue, Brooklyn, N. Y., Dept. M-3

Please send me further information on the Schrader air cylinders and valves.

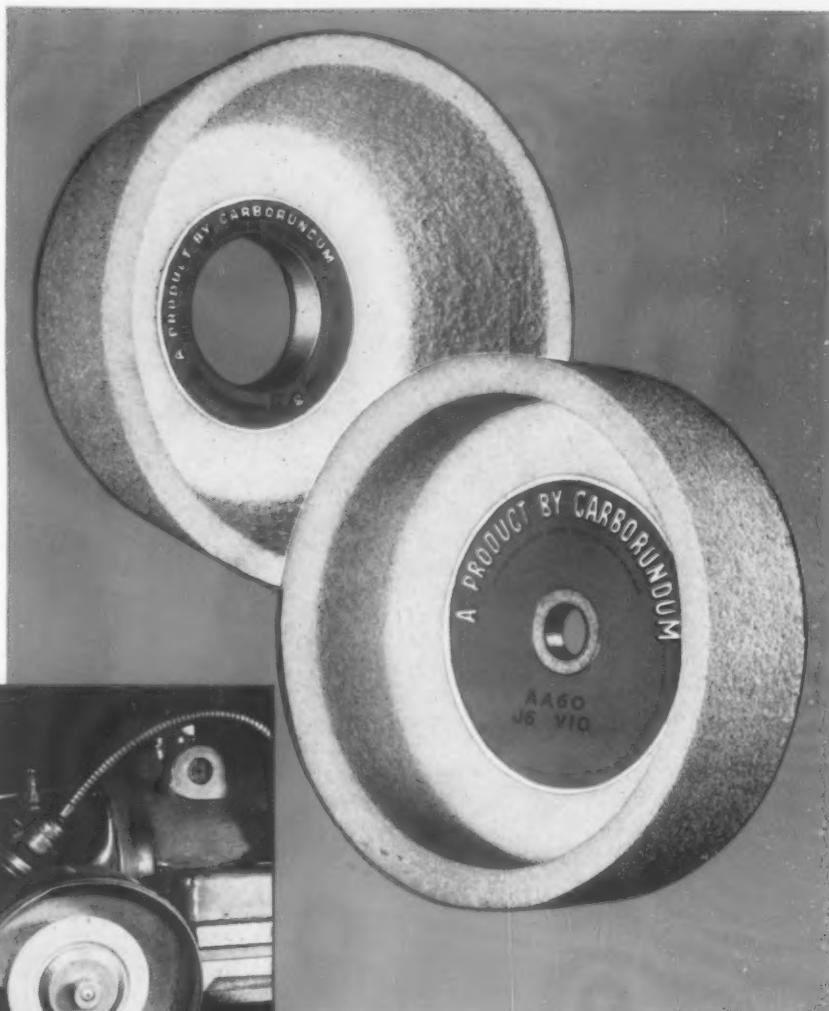
Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# INCREASE YOUR TOOL LIFE



ALOXITE AA V10 Bond aluminum oxide wheels are specifically designed to provide accurate, economical grinding of all tool steels. High stock removal with a minimum of heat generation. Good finish with extended tool life between grinds. V10 Bond wheels are ideal for many diversified tool-room operations. Readily recognized by distinctive white color. Write Dept. TE 81-18 for information on CARBORUNDUM's complete simplified tool-room wheel line.

*Only* **CARBORUNDUM**

TRADE MARK

*makes ALL Abrasive Products  
...to give you the proper ONE*

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N.Y.

July, 1957

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-133

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**PARKER • MAJESTIC**



**PRECISION MACHINES**

*Above is pictured the home and products of the*  
**PARKER-MAJESTIC, INC.**

For over twenty-one years this company has manufactured the Parker Spindles used in Precision Grinding, Boring and Milling applications.

Supplementary products include the well known line of Parker-Majestic Internal, External, No. 2 Surface and Rotary Surface Grinders.

*Descriptive literature upon request.*

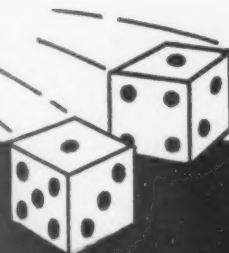
**PARKER-MAJESTIC, INC.**

*formerly* **MAJESTIC TOOL & MFG. CO.**

147 JOS. CAMPAU

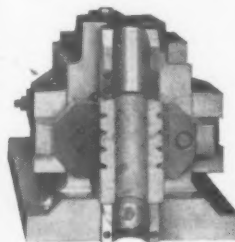
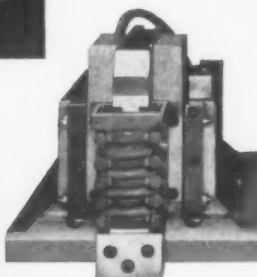
• DETROIT 7, MICHIGAN

# LAPOINTE



## BROACHING FIXTURE

Don't take a chance on poorly designed or poorly built fixtures! The odds are *all against you*, and you'll end up with substantial money losses resulting from serious production headaches.



Photos show the broaching of Main Bearing Caps (joint face and half round) at a speed of 100 or more clusters per hour . . . 5 bearings to a cluster. Machine: Heavy-duty LAPOINTE Double Ram Vertical BROACHING MACHINE, 25-ton, 78" stroke. Cutting speed 40 f.p.m.

LAPOINTE TIP-DOWN FIXTURES have become the *accepted standard*. Here's why:

- 1 Accurate, fast, versatile — they will handle 80% of all surface-broaching requirements.
- 2 Convenient to load — eliminate fatigue. They bring the work holder out front, *where the operator can see it and get at it*.
- 3 Safe to operate.
- 4 Permit use of a great variety of work holders that can be manually or hydraulically clamped.
- 5 Allow use of fully adjustable work holders to compensate for broach wear.
- 6 Utilize full stroke of machine.
- 7 Sturdy and rugged.

**TIPS DOWN** into convenient position for loading and unloading, with locating points in clear view of operator for fast part handling.

**TIPS UP** for broaching, with sturdy, rigid support locked securely against hardened and ground stops on both sides of trunion blocks.

**LAPOINTE** takes the responsibility for the entire job: machines, tools and fixtures.

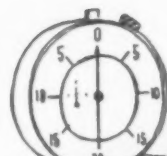


*rely safely on* **Sidney  
Herringbone Gears**

**FOR TOOTH-TO-TOOTH ACCURACY**

**SUPERIORITY** is achieved by extreme accuracy, more tooth contact resulting in greater strength and smoother action, with end thrust eliminated through the double opposed helix angles.

**ACCURATE TOOTH CONTOUR**, gradual engagement and oblique lines of contact assure correct tooth action and **KEEP WEAR TO A MINIMUM**. Especially suited for carbide cutting tools.



● Write for details or contact  
nearest Sidney representative

**SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO**

**BUILDERS OF PRECISION MACHINERY SINCE 1904**

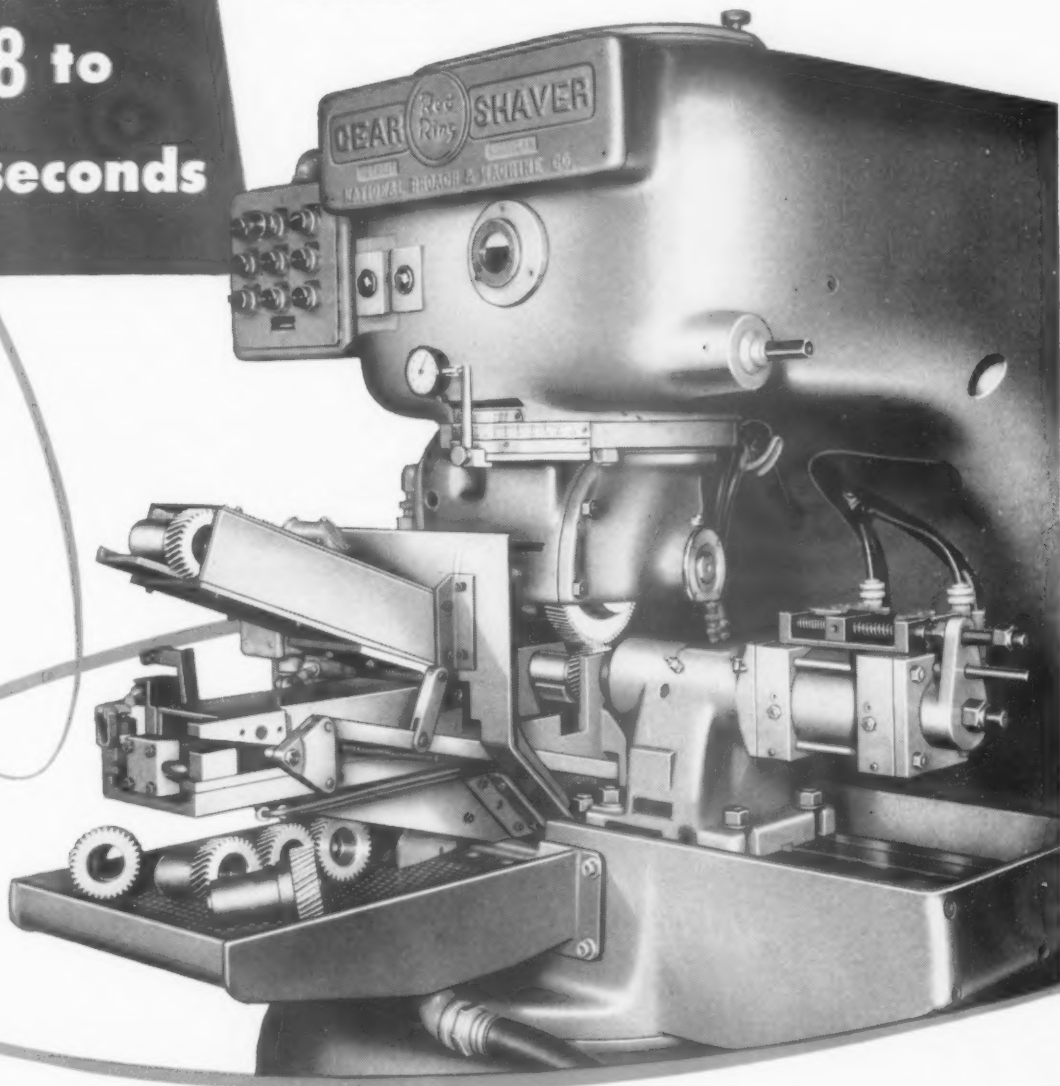
# Transmission Gears

shaved in  
18 to  
22 seconds

The gear on this automatic transmission reverse drive sleeve is  $2\frac{5}{8}$ " in diameter with a  $\frac{7}{8}$ " face, 33 teeth and 14 normal D.P.

It is being shaved on this Red Ring Diagonal Gear Shaving Machine equipped for fully automatic loading at a rate of from 165 to 200 per hour, removing .0025" to .0015" of stock on tooth thickness. Rates up to 300 per hour have been recorded on smaller automotive transmission gears.

Automatic loading gives you not only the highest production rates, but it also minimizes operator fatigue and assures extremely close tolerance gears with ordinary machine operators—no special skill is needed.



WRITE FOR DESCRIPTIVE LITERATURE ON  
RED RING GEAR SHAVING AND AUTOMATIC LOADING

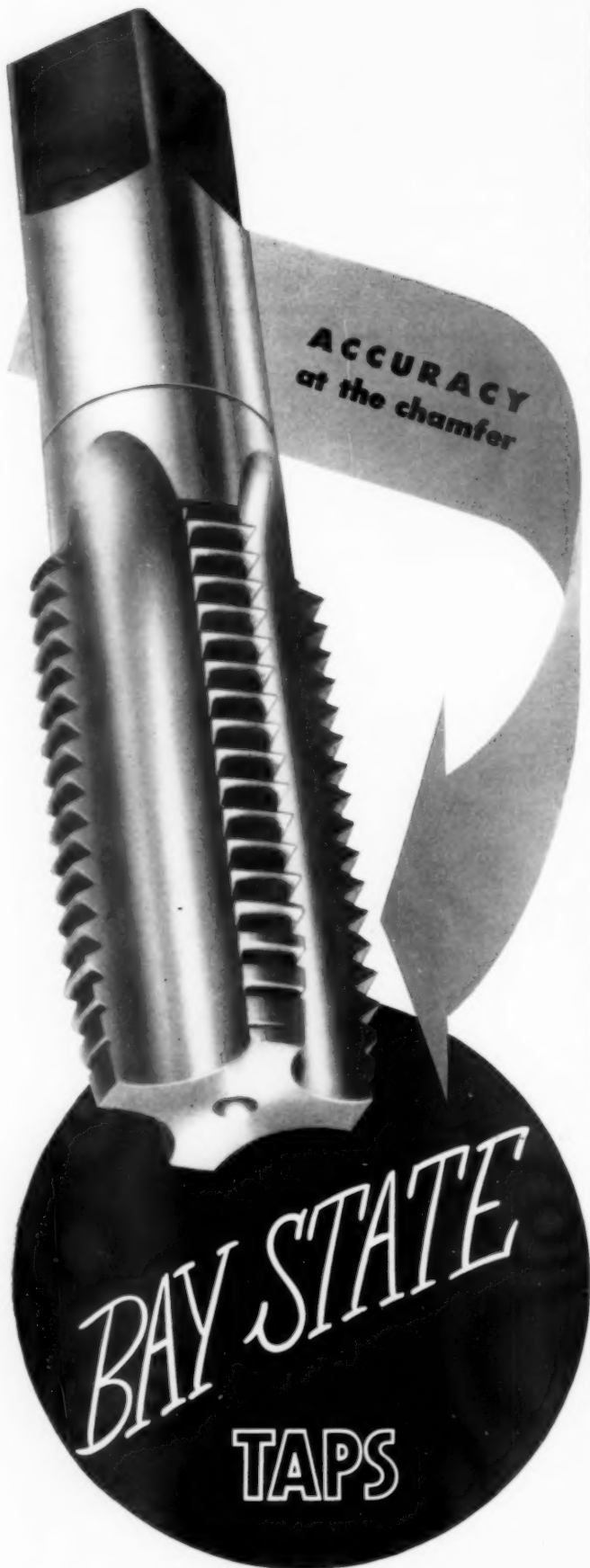


**NATIONAL BROACH AND MACHINE CO.**

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

SPUR AND HELICAL  
GEAR SPECIALISTS  
INTEGRATORS OF ROTARY SHAVING  
AND ELLIPTICAL TOOTH FORM

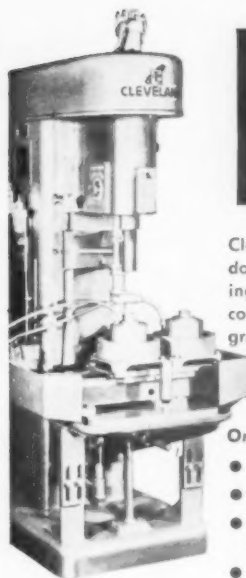


ON NEARBY SHELVES OF INDUSTRIAL SUPPLY DISTRIBUTORS

**BAY STATE TAP & DIE CO.**  
MANSFIELD, MASS.

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138



## CLEVELAND TAPPERS

*Cut Tapping Costs by Combining Operations*

Cleveland engineers can save production dollars and valuable working time by designing a CLEVELAND TAPPER which will not only combine several operations but also tap groups of holes at one stroke of the machine.

### Check with Cleveland FIRST

Only CLEVELAND offers you all these features.

- Precision hardened and ground lead screw.
- Fully automatic or manual control.
- Precision depth control for blind hole tapping.
- Heat treated alloy steel spindles for maximum strength.
- Easily changed spindle speeds.
- Exclusive super sensitive clutch reduces breakage and increases tap life.
- Positive coolant and lubricant supply under constant control of operator.
- Rigidly constructed to give years of service.
- Maximum safety for operator and machine.

WRITE FOR PRODUCTION TAPPING GUIDE T-5

### THE CLEVELAND TAPPING MACHINE CO.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC., CANTON 4, OHIO

USE READER SERVICE CARD; INDICATE A-7-138-2

**THE TAPERED SEAT ASSURES ACCURACY OF  $\pm .0001$**

*Empire*  
**LIVE CENTERS**  
ARE • VERSATILE  
• ACCURATE • HEAVY DUTY

Manufactured in all tapers. 1 to 6 MT in stock. Special shanks and points made to order.

Ask your Supplier or Write for Literature.

### ROYAL PRODUCTS

90 UNION ST.

MINEOLA, N. Y.

Points illustrated are standard.

USE READER SERVICE CARD; INDICATE A-7-138-3

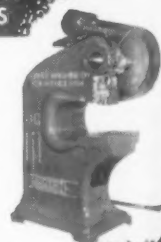
## EFFICIENT—LOW COST PRODUCTION MEANS ROUSSELLE PUNCH PRESSES



O. B. I. PRESS



HORN PRESS



DEEP THROAT

WRITE FOR DETAILS

### SERVICE MACHINE COMPANY

7627 S. Ashland Ave.

Chicago 20

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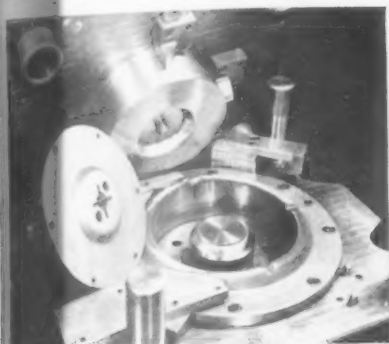
The Tool Engineer

# Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



A-H5 tool steel is the backbone of this die which forms the flywheel element of a Borg-Warner automatic transmission from .1495-in. steel sheet in a 1000-ton press. This die must hold accurate size during hardening because it produces precision parts.

## Precision dies of A-H5 for Borg-Warner transmissions

Talk to the production men at McIntosh Stamping Co., in Detroit. Ask them how they like the A-H5 tool steel they're using in many of their precision dies. They'll tell you it's doing a good job. It's highly resistant to distortion during heat-treatment. It wears well on long runs, has durable cutting edges, and takes a lot of shock in heavy-duty stamping presses.

A-H5 is our 5 pet chromium air-hardening grade that comes close to the high-carbon, high-chromium grades in its safe, accurate hardening properties. Yet it's as economical as most oil-hardening grades. Easy to machine and heat-treat, too. It's being used more all the time by tool and die makers who want a general-purpose grade, one that's a consistently fine performer and needs no pampering.

## Customer in Jam, Distributor Flies Tool Steel to Him in Own Plane

The phone rang the other day at the home of one of our distributors while he was at breakfast. It was one of his New England customers in a city several hours distant by car.

"I'm in real trouble," moaned the customer. "I need some tool steel in the worst way. And I've got to have somebody to show us how to heat-treat it. Every hour is costing me plenty!"

Our distributor jotted down the details and grabbed his hat. He rushed over to his warehouse, had the short bars cut to exact length, and loaded them in his car. Then he headed for the airport. Here was his chance to cash in on his week-end flying lessons!

At the airport they had a red monoplane ready, engine warmed up and rarin' to go. In a matter of minutes he was taxiing down the field and off he roared into the wild blue yonder. And in less than two hours after the phone call he was delivering the tool steel and giving the grateful customer some pointers on how to heat-treat it for best results.

Not every Bethlehem distributor can personally fly tool steel to you to meet an emergency. But when you need fast de-



livery, your Bethlehem distributor is ready to rush your order for popular grades and sizes of carbon tool steel, oil- and air-hardening grades, shock-resisting, hot-work, and high-speed steels. He carries tool bits, brake die steel and other specialties that you need frequently. And he knows that he can call on the Bethlehem tool steel metallurgists to solve unusual problems and to handle special orders with our mill and laboratories.

They're mighty capable folks to depend on for tool steel service, whether it's an emergency, a tough problem, or a routine requirement. That's why we say: "Hats off to the Bethlehem Distributors! They're doing a real job!"



**Our Tool Steel Engineer Says: Decarburized surfaces cause premature tool failures**

Most toolmakers know that decarburized metal must be removed completely from the working surfaces of tools. But it is not so widely known that it's often best to remove this skin from other portions of the tool.

This precaution is especially necessary on tools subject to repeated impacts. For example, a pneumatic chisel having a forged shank often breaks because of a

fatigue failure. Usually there is a stress concentration in the shank, due to the change in section; and when this tool surface is also decarburized, rapid failure in service can occur.

The outer layers of a decarburized tool just don't have the strength of the effectively hardened tool steel base. The only safe thing to do is grind off the "decarb" on all tool surfaces.

**Bethlehem**



**Tool Steel**



A-H5 tool steel adds wear and shock-resistance to this high-production die, hardened to Rockwell C-58, which forms the back-plate for a direct-drive clutch from .2002-in. steel sheet in a 250-ton press.

Photo courtesy of McIntosh Stamping Co., Detroit. Parts used in fatigue converter made by Long Mfg. Co., a division of Borg-Warner Corp.

# V-LIER for VICTORY over PRODUCTION DELAYS



Machine Tool Specialties

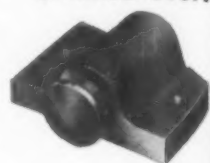
## SPRING PLUNGERS

Widely used in Dies for breaking oil seals. Because these complete units are more easily removed than "home-made" spring plungers, disassembly of Dies for maintenance is simplified and effects savings up to \$72.00 per Die. Another popular use is for positioning work pieces. They are also ideal for many end product applications. Each unit is precision-built for trouble-free operation. Available in ten sizes with end pressures of 3 to 42 lbs.



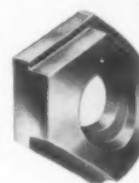
Designed to position work pieces quickly or for any other use where a spring holding tension of 14 or 32 lbs. is desired. Each unit is made with a cast iron body with a hardened steel plunger having a radiused nose. Body has jig bored holes for precision mounting. These tough units are built to give years of money-saving service.

## SPRING STOPS



## FIXTURE KEYS

V-Lier multi-dimensional fixture keys are counter-bored hex nuts with accurately milled stepped sides whose different cross dimensions are held to a tolerance of  $\pm .0005$ ". By attaching to a fixture base, rotating the key to the desired side dimension and sliding into the mill table slot, set-up time is virtually eliminated — any idle machine can be quickly put to work. Available in seven sizes, each with three different dimensions; or made up to your order.



See your local V-Lier distributor or send for complete information.

**V-LIER MANUFACTURING CO.** 4552-54 BEVERLY BLVD. LOS ANGELES 4, CALIF.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-140-1

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 85.

No Postage Needed



## Engineering and Design Service

Let Scully-Jones experienced engineers design your dies, fixtures, gages, jigs, machines, products and cutting tools.

**COMPLETE SERVICE, DESIGNING AND BUILDING  
METHODS ENGINEERING, PROCESSING AND DRAFTING**

Write or call Bishop 7-5907 for Bulletin No. 15-50 on Scully-Jones Engineering and Design Service. It shows how S-J engineers work in your plant or ours to save you time and money.

**SCULLY-JONES and COMPANY**  
1915 So. Rockwell St. Chicago 8, Illinois



USE READER SERVICE CARD; INDICATE A-7-140-2

Over 85% of the torque wrenches used in industry are

## STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces  
...inch pounds  
...foot pounds  
(All sizes from  
0-6000 ft. lbs.)



Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. **STURTEVANT CO.**  
ADDISON [QUALITY] ILLINOIS

USE READER SERVICE CARD; INDICATE A-7-140-3

# UPS PRODUCTION 25% BETWEEN DIE GRINDS

## DoALL "COOL-GRINDING"

(U.S. PATENT NO. 2470350)

**GIVES  
IMPROVED FINISH  
ON HIGH CARBON  
HIGH CHROME  
NN STEEL**

"COOL-GRINDING" WILL PREVENT BURNED OR  
SCORED FINISH, LENGTHENS THE LIFE OF YOUR TOOLS



"Cool-Grinding" takes liquid in at the hub of the wheel, and through centrifugal force passes it through the pores of the wheel and out as a fine mist at the point of contact between the wheel and the work.

SEND FOR CATALOG Today

—see how "Cool-Grinding" works,  
why it is better, how it will benefit you  
—see the different models of DoALL  
Precision Grinders for toolroom or  
production work.



INDUSTRY'S NEW TOOLS

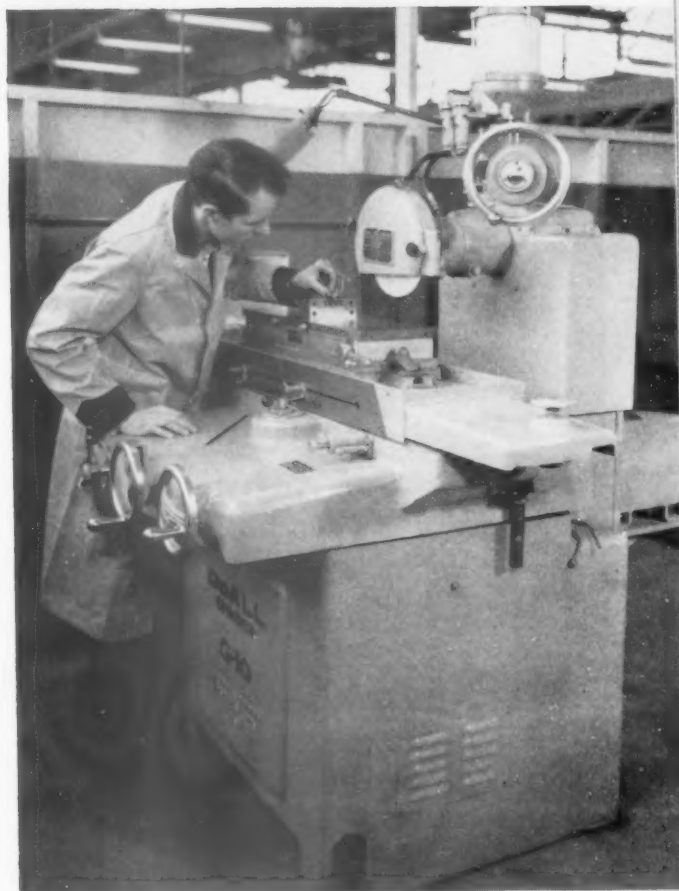
THE DoALL COMPANY • 254 N. LAUREL AVE. • DES PLAINES, ILL.

27 SALES-SERVICE STORES

CALL DoALL FOR:

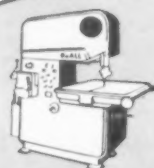
GR-2

# DoALL



ONWARD Manufacturing Company, Ltd., Kitchener, Ont., knows the benefits of DoALL "Cool-Grinding." They say, "Since using this Grinder with "Cool-Grinding" we have obtained a 25% increase in number of pieces per die grind over former methods of grinding."

WHY? Because DoALL "Cool-Grinding," with coolant flowing through the wheel, prevents excessive heat that scores, draws the temper or checks the metal finish. The finish is smoother, too. The die does more work before it needs grinding. You save time and money and material. Ask to have a Free DEMONSTRATION of DoALL "Cool-Grinding" at your own plant. Call your local DoALL Sales-Service Store or write:



Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies



Short-cut to a  
fine preplating  
finish --

## RESINIZED METALITE® CLOTH BELTS

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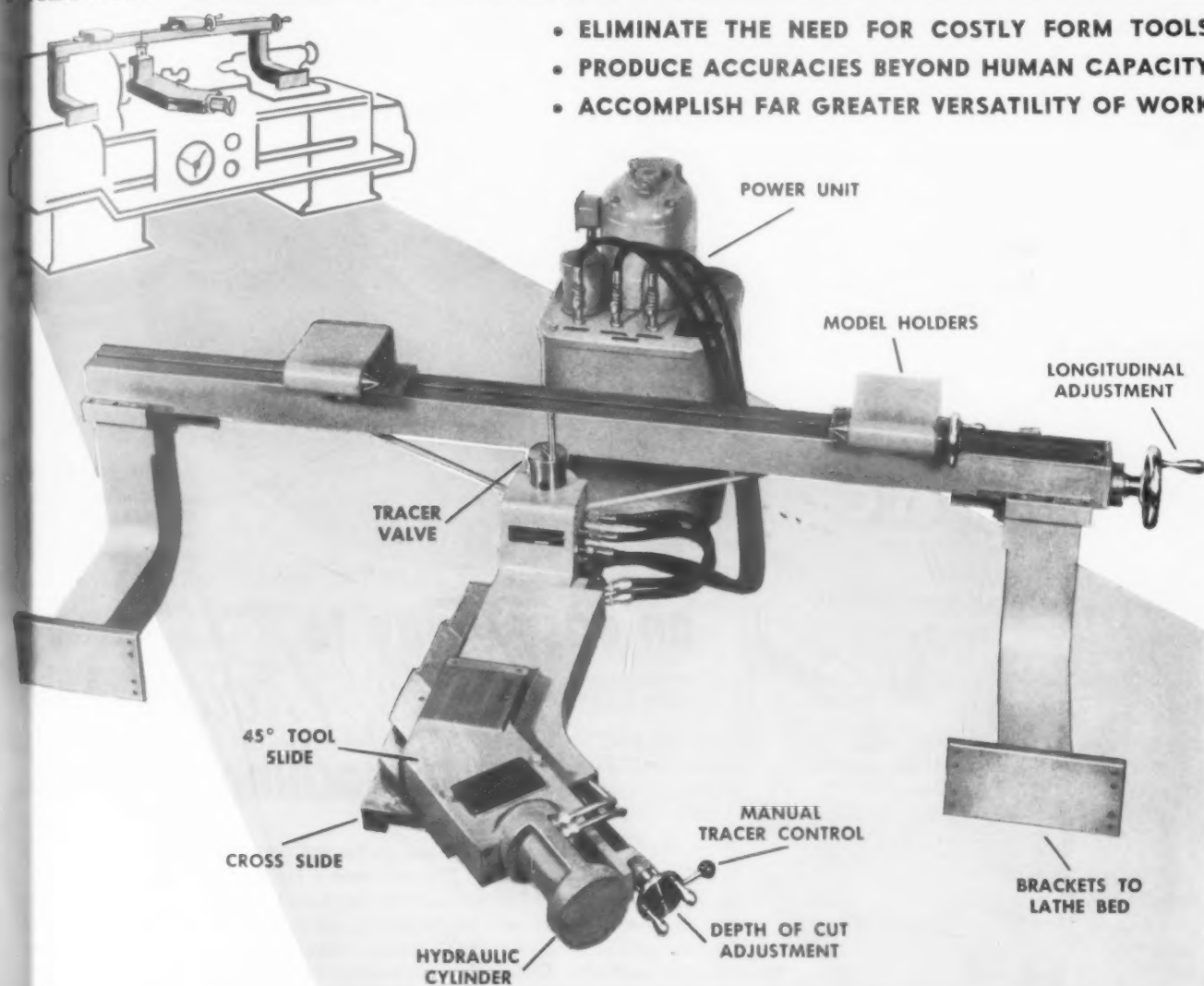
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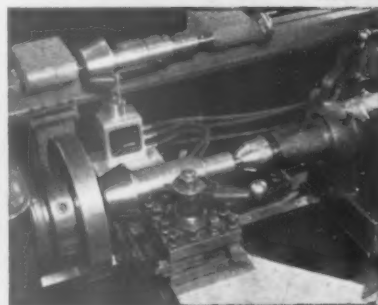
A few of thousands of Turchan-turned jobs show the wide variety of work handled.

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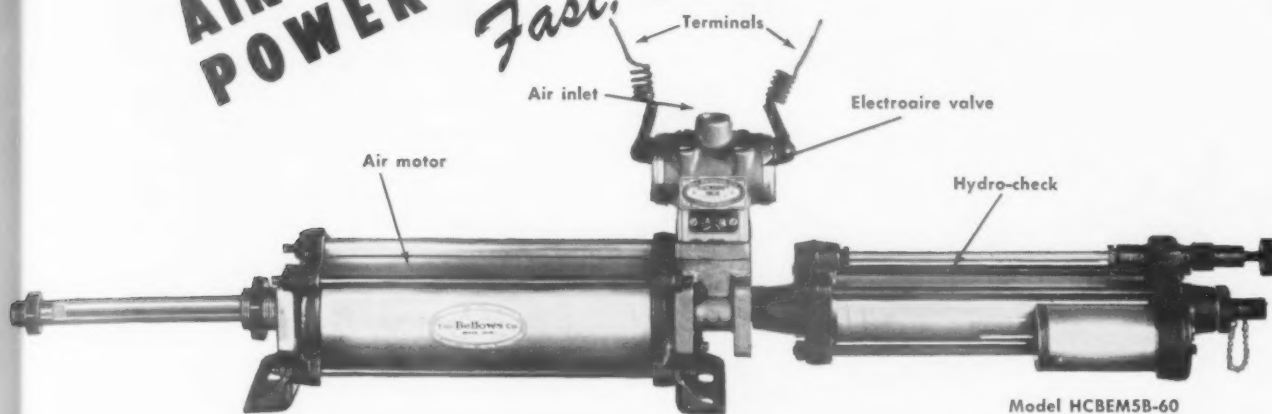


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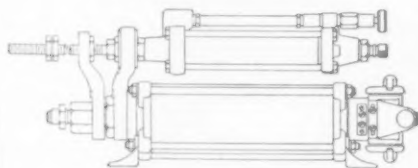
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*Fast, Smooth, Compact*



## TWO MOUNTING STYLES

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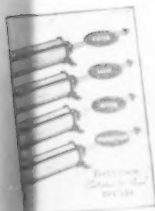
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1255

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a difference  
whether

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or the machine  
is **BUSY**



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spells **PROFIT**

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WHAT'S THE FASTEST  
WAY TO CLEAN METAL?

See page 11

WHAT'S THE MOST  
ECONOMICAL WAY?

See page 9

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The Tool Engineer

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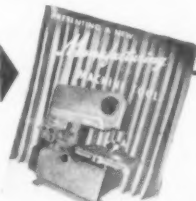
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BAND MACHINING  
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Learn about the complete machining facilities offered by this modern band machine.



8-1

27  
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STORES



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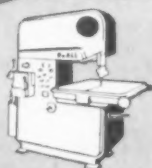
You can cut anything with a DoALL MP-20 Contour-matic — any material, any shape. Ask to have a *demonstration* of this versatile, time, money and material-saving machine tool right in your own plant. A DoALL sales service engineer will bring it to you, *show you* what it can do. Call your local DoALL Sales-Service Store or write:

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NEW  
TOOLS

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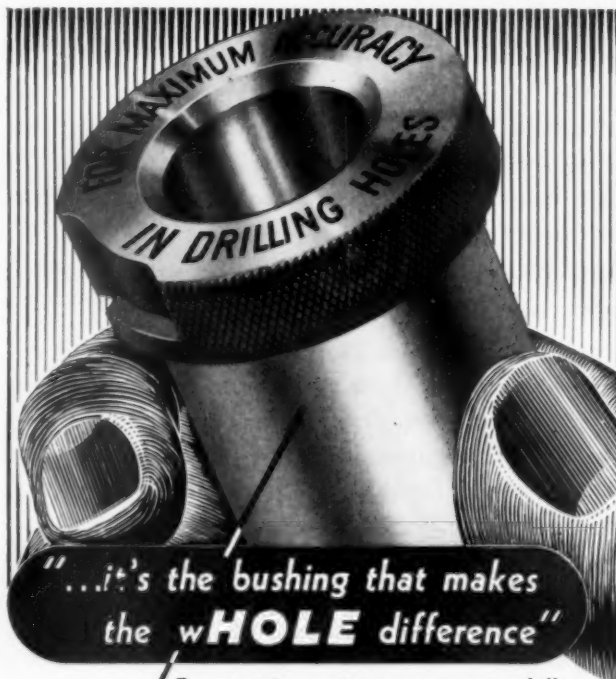
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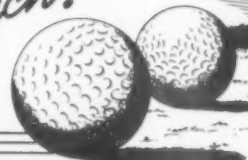
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fraction of  
an inch?*



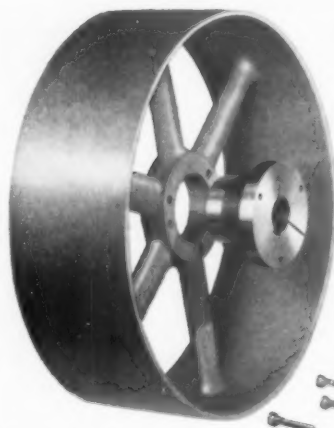
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The Tool Engineer

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July, 1951

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JULY, 1951

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400 Madison Ave.  
Phone: Plaza 9-4018  
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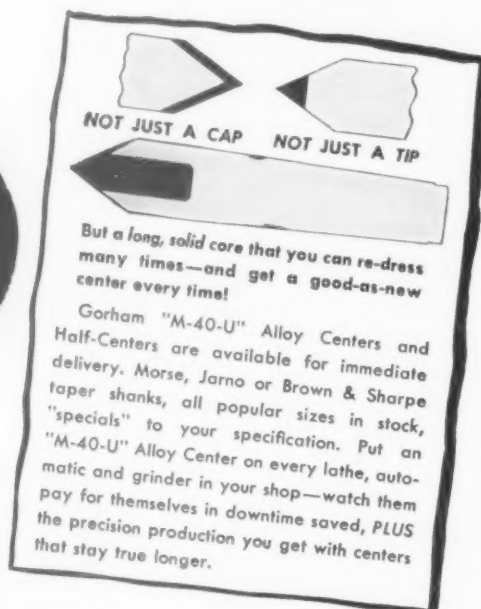
"M-40-U" is a special alloy developed by Gorham expressly for use as a wear, heat and abrasion-resistant metal. A core of this material is induction brazed in the steel shank of the center, after which the entire center is finish ground. Thus, the wear material is always supported by the tough shank steel

throughout the life of the center. These centers require only a cleanup grind when wear finally occurs, and many cleanup grinds can be made without loss of wear-resistant properties, since the "M-40-U" alloy is actually a deep core, rather than a clad or applied tip.

## Gorham TOOL COMPANY

"EVERYTHING IN STANDARD OR SPECIAL CUTTING TOOLS"

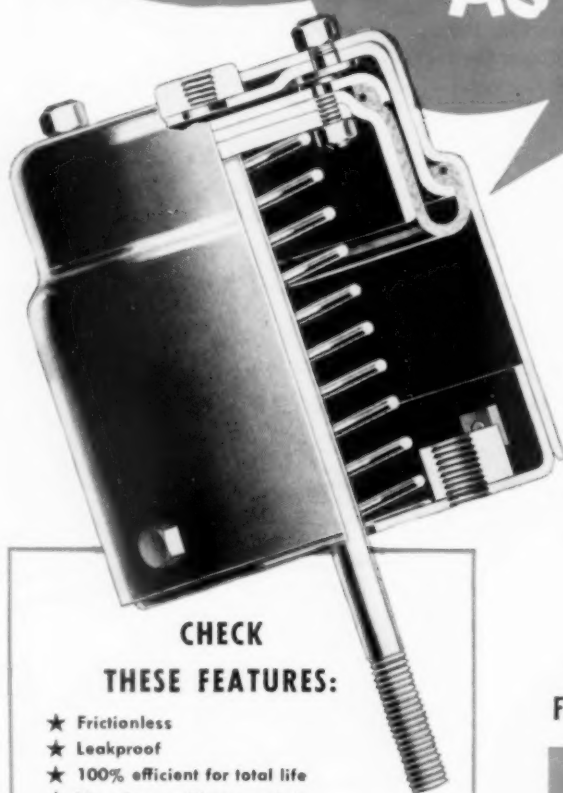
14407 WOODROW WILSON • DETROIT 3, MICHIGAN



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 AS 30%**



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- ★ 100% efficient for total life
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- ★ Diaphragm has rolling action and exceptionally long life
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- ★ Easily installed



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 LOW COST AIR CYLINDER!**

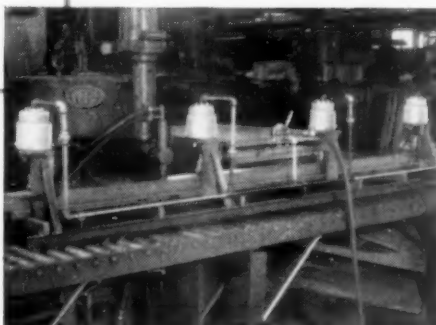
The pressure for production is on! Manufacturers everywhere find it increasingly difficult to keep pace with the demands of the day. But there is a way—a brand new way requiring no addition to manpower, no addition to plant facilities. The answer? Remarkable Bendix-Westinghouse Robotair Industrial Controls. With their wide range of applications, Robotair controls offer you amazing improvements in production speed and economy through increased productivity of man and machine at *unbelievably low initial cost*. Robotair units are available as original equipment for machinery manufacturers or for easy installation on shop equipment.

*Send today for an informative booklet and find out how you can cut costs, speed production with Robotair! Address Bendix-Westinghouse Automotive Air Brake Co., Dept. H, Elyria, Ohio.*

**FOR HOLDING, CLAMPING, BENDING, SWEDGING, STAKING, RIVETING**

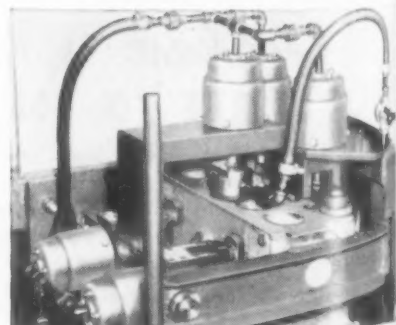
# ROBOTAIR

**THE INDUSTRIAL AIR CONTROL OF A THOUSAND USES**



**REDUCES OPERATOR FATIGUE**

Four Rotochambers installed on the fixture in this spot welding operation replaced cumbersome hand clamps, saving time, greatly reducing operator fatigue.



**SPEEDS INSPECTION METEORICALLY**

Installation of Rotochambers on this water test operation for engine castings eliminated hand operated fixtures, thereby speeding inspection and cutting costs.



**HAND  
DETACHABLE  
EVEN AFTER THE  
TOUGHEST  
CUTS**

**CONTINENTAL  
STANDARD DRIVE  
COUNTERBORES**



Above: Counterboring a hole in a cast iron machine base. Uniformity of chips indicates free-cutting action; chip disposal is aided by wide flutes. And when the operation is finished the cutter is removed from the holder with a simple twist of the wrist.

**T**here's no wedging action in Continental Standard Drive Counterbores. Cutters are removable from the holder with a simple *twist* of the wrist, even after the toughest cuts. Double driving lugs on the cutters engage double abutments in the holders to give a balanced,

positive drive that practically is indestructible. Double bearing areas in the drive assure rigidity and proper alignment of cutters and holders. Continental Counterbores are available individually or in sets that include holders, cutters, countersinks and pilots in practical size ranges.

**CONTINENTAL TOOL WORKS**

Division of Ex-Cell-O Corporation  
DETROIT 32, MICHIGAN

Continental Counterbore Sets, available in your choice of three sizes, are fully described in Bulletin D27161. Send for your copy.



"Savings have ranged from 33% on 1/16" stock to 75% on 5/16" stock (dead soft). These percentages apply to limited production quantities of from 25 to 200 units."

"This machine has now been in operation for approximately eight months in the fabrication of a wide variety of sheet metal parts where production volume is relatively low, that is up to approximately 200 pieces per run. Outstanding savings in production time have been accomplished compared to other methods."

"We have been able to make substantial savings in the production time of our parts over previous methods of fabricating."

"One example was the production of 200 brackets 3-3/4"x-1/2" using 11 gauge mild steel sheet. This job required punching 7 round holes ranging from 1/8" dia. to 1/2" dia., plus nibbling two radius slots 7/32" wide and 1-1/4" long. Total Wales Fabricator time was .01737 hours per piece, or a total of 3.474 hours for 200 pieces plus 1.167 hours setup time. Total saving on actual time studies on record."

# REORDERS

## ... PROOF THAT USERS ARE REALLY CUTTING COSTS WITH WALES Fabricator

Repeat orders prove the axiom—"It's not what we say but what we do that counts." Yes, repeat orders are the most concrete evidence of customer enthusiasm for Wales Fabricators wherever limited runs justify expensive, single purpose dies for punching, notching or nibbling.

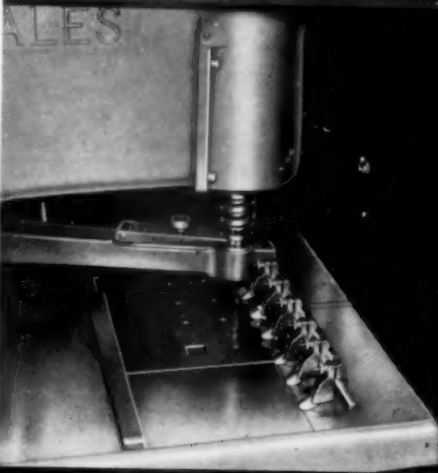
This revolutionary Wales Fabricator with ram that actuates 100 strokes per minute and with Wales patented "Quick Change" System makes possible startling, "never-heard-of-before" time study figures. **SEE RESULTS AT LEFT.**

Write TODAY for packet of time studied parts and fully illustrated, functionally-colored Catalog 10-A.

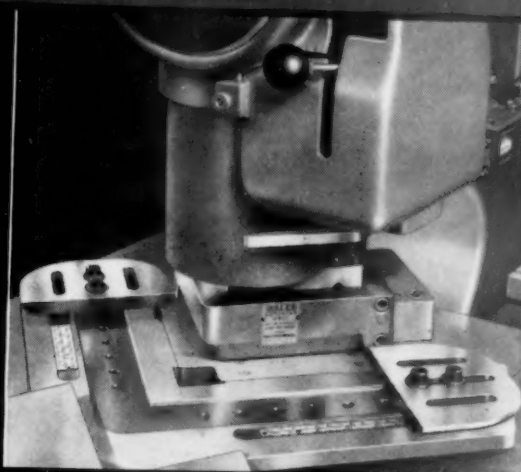
### WALES-STRIPPIT CORPORATION

George F. Wales, Chairman  
393 PAYNE AVE., NORTH TONAWANDA, N. Y.  
(Between Buffalo and Niagara Falls)  
Wales-Strippit of Canada Ltd., Hamilton, Ontario  
Specialists in Punching and Notching Equipment

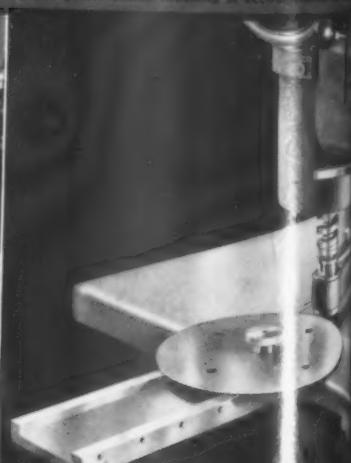
PUNCHING... Illustrating Wales Fabricator punching holes in sheet. Note adjustable fingers for quick gauging of the work.



NOUCHING... Illustrating a Wales Notching Unit in operation in the Wales Fabricator.



NIBBLING... Showing the Wales Fabricator nibbling of guide plate. Inside nibbling is accomplished with...



H & W

LIMIT